THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXI. No. 1831.] LONDON, JUNE 14, 1898. [50TH YEAR. PRICE 6d.

TUBES AND FITTINGS
FOR
GAS, STEAM, WATER,
AND ALL PURPOSES,
ALSO
COILS OF EVERY SIZE AND SHAPE.

Apply to the Original Firm of
JOHN BROTHERTON
LIMITED,
Imperial Tube Works, Monmore Green,
WOLVERHAMPTON.
ESTABLISHED 1861.

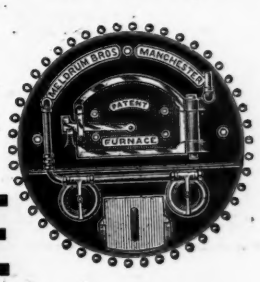
Lanemark Coal Co.,
LIMITED.
LANEMARK CANNEL AND GAS COALS.
Quotations and Analysis on Application to
LANEMARK COLLIERY,
NEW CUMNOCK, N.B.
Shipping Ports: All the principal Scotch Ports.

— ESTABLISHED 1830. —
PARKER & LESTER,
Manufacturers & Contractors.
THE ONLY MAKERS OF
PATENT ANTIMONY PAINT,
Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores, for Gas and Water Works.
WORKS:
ORMSIDE STREET, OLD KENT ROAD,
LONDON.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.
Prices and Analysis of all the Scotch Cannels on Application.

CARLESS, CAPEL & LEONARD,
HOPE CHEMICAL WORKS, HACKNEY WICK, LONDON, N.E.,
And at Pharos Works, Hackney Wick.
NAPHTHA AND GASOLINE DISTILLERS AND PETROLEUM IMPORTERS,
Specially distil Carburine Spirit, specific gravity ·680, or of any other grade suitable for Enriching Gas; also Gas Oil best adapted for injecting into the Retorts, as in the Herring Process.
Importers of Petroleum for Carburetting Water Gas, or for Manufacturing Oil Gas. Distillers of Pentane Petroleum Ether, and Naphtha for clearing the pipes of Naphthaline, &c.
Samples and Prices may be had on application.

"MELDRUM'S"
PATENT
BREEZE FURNACE



Now used in most of the Gas-Works in this Country for burning
COKE BREEZE, PAN BREEZE, SWEEPINGS, COAL DUST, &c.
5600 in use.

MELDRUM BROS., Atlantic Works, **MANCHESTER,**
Also at LONDON, LEEDS, LIVERPOOL, BIRMINGHAM, NEWCASTLE, and GLASGOW.
Branch Houses at PARIS, NEW YORK, BOMBAY, TOKIO, and SYDNEY.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER & BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM

(ESTABLISHED 1765).

MANUFACTURER OF TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST IRON TANKS FOR DITTO,

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

DRAWINGS, SPECIFICATIONS, AND ESTIMATES SUPPLIED ON APPLICATION.

EDWARD COCKEY & SONS, Ld.

MANUFACTURERS OF PURIFIERS OF ALL SIZES,

With Improved Centre-Valves, to work either One, Two, Three, or Four Purifiers at one time.

SLIDE VALVES.

SCREW VALVES.

SEAL-REGULATING VALVES.

GASHOLDER VALVES.

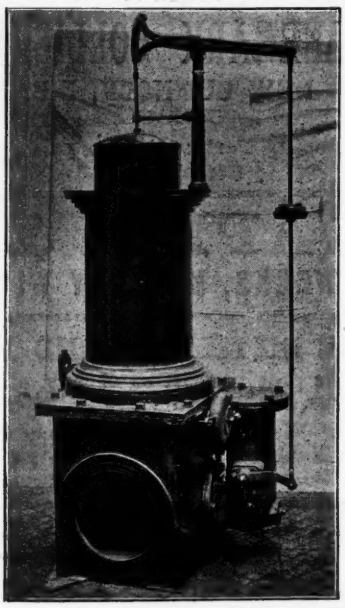
FOUR-WAY VALVES.

DISC VALVES.

SELF-ACTING BYE-PASS VALVES.

COMPENSATING VALVES.

IMPROVED COMBINED SELF-ACTING BYE-PASS & COMPENSATOR for EXHAUSTERS



Hand-Power LIFTS, suitable for weights up to 10 Tons.

Hydraulic Power GOLIATHS, suitable for any Weights.

Improved WOOD GRIDS for Purifiers and Scrubbers.

Specially Designed for use where Space is limited.

SPECIFICATIONS AND PRICES ON APPLICATION TO—

THE IRON-WORKS, FROME, SOMERSET.

Telegrams: "COCKEYS, FROME." London Agents: Messrs. BALE & HARDY, Bridge House, 181, Queen Victoria St., E.C. Telegrams: "DAMPER, LONDON."

HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.

—11 MEDALS.—

MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.

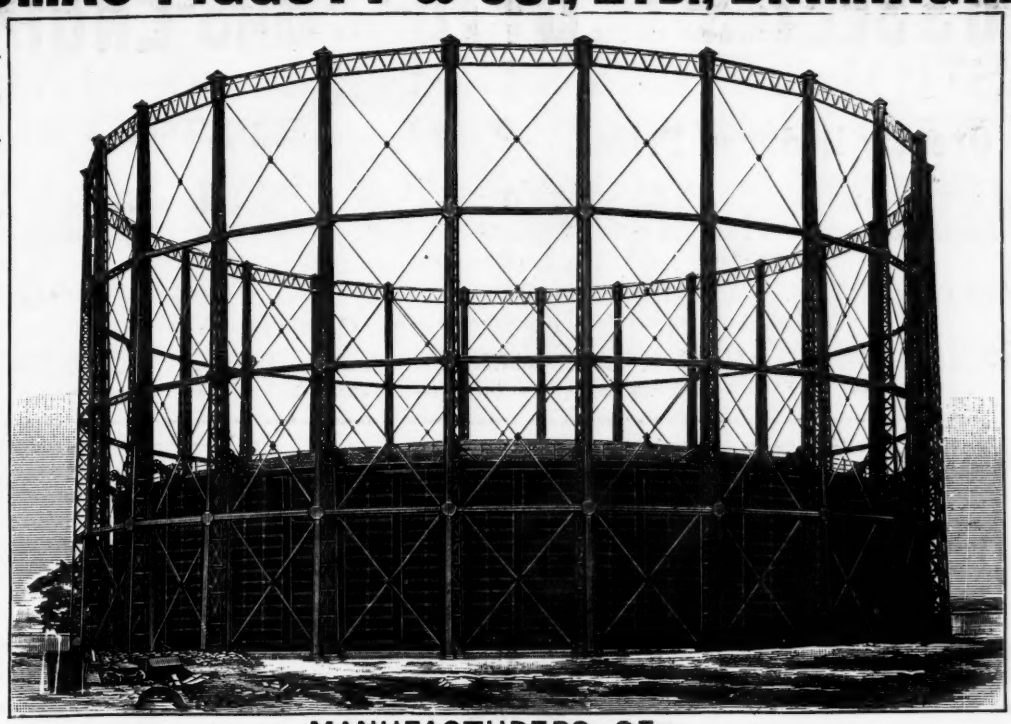
SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

LONDON: 108, Southwark Street. MANCHESTER: 33, King Street West. BIRMINGHAM: 114, Colmore Row. LEEDS: 6, Mark Lane, New Briggate.

THOMAS PIGGOTT & CO., LTD., BIRMINGHAM.

LONDON OFFICE: ST. THOMAS APOSTLE, E.C.

GAS PLANTS, BOILERS, ENGINES, PUMPS, ROOFS, RETORT FITTINGS, ETC.



TELEGRAPHIC ADDRESS: ATLAS BIRMINGHAM

WELDED & RIVETED PIPES, FOUL MAINS, RETORT LIDS, WROT & CAST TANKS, PURIFIERS.

MANUFACTURERS OF

Humphreys & Glasgow's Patent Carburetted Water-Gas Plant.

INSTALLATIONS HAVE ALREADY BEEN SUPPLIED, AND ARE IN HAND FOR THE FOLLOWING GAS-WORKS: COPENHAGEN, BELFAST, GLASGOW, BRUSSELS, SANTIAGO, SWANSEA, TOTTENHAM, LIVERPOOL, BRIGHTON, BATH, PRESTON, SOUTHPORT, NEW YORK, NEWBURGH (N.Y.), NEWBURGH (SECOND CONTRACT), HOYLAKE, BELFAST (SECOND CONTRACT), EDINBURGH, TOTTENHAM (SECOND CONTRACT), WINCHESTER, MANCHESTER, BRUSSELS (SECOND CONTRACT), ST. JOSEPH (MO.), HOLYOKE (MASS.), SHANGHAI, STOCKTON, STOCKPORT, NORWICH, GUILDFORD, SYRACUSE, BORDENTOWN, LEA BRIDGE, COVENTRY, COMMERCIAL, BRENTFORD, BRIDLINGTON, MIDDLESBROUGH, CROYDON, L. & N. W. RAILWAY CREWE, NINE ELMS, BROMLEY, COVENTRY (SECOND CONTRACT), TAUNTON, ROTTERDAM, DORKING, LEA BRIDGE (SECOND CONTRACT), LIVERPOOL (SECOND CONTRACT), SCARBOROUGH, DURHAM, PERTH (WESTERN AUSTRALIA), COMMERCIAL (SECOND CONTRACT), COMMERCIAL (THIRD CONTRACT). MAIDENHEAD, EPSOM, NORTH MIDDLESEX, BREMEN, WANDSWORTH, FALMOUTH.

WOMBWELL MAIN COMPANY, LD.,

BARNSLEY.

BEST GAS COAL.

ANALYSIS: 11,390 feet of 17-Candle Gas. Value in Sperm per ton, 686 lbs.

By R. O. PATERSON, C.E.

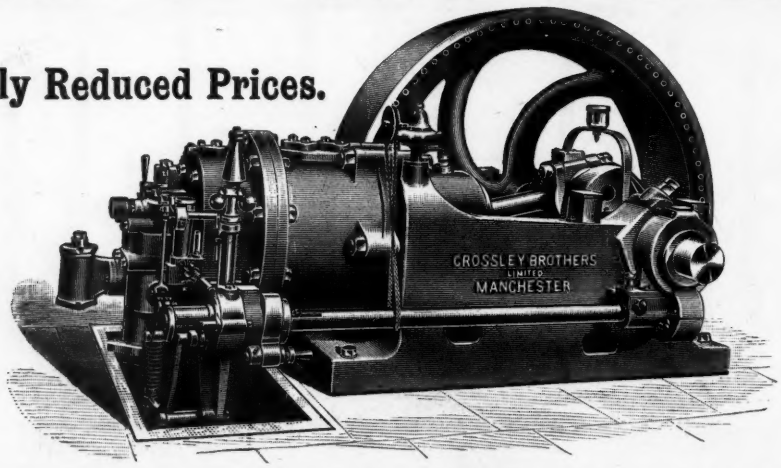
APPLY

WOMBWELL MAIN COMPANY, LIMITED, BARNSLEY.

Telegrams: "MAIN, WOMBWELL."

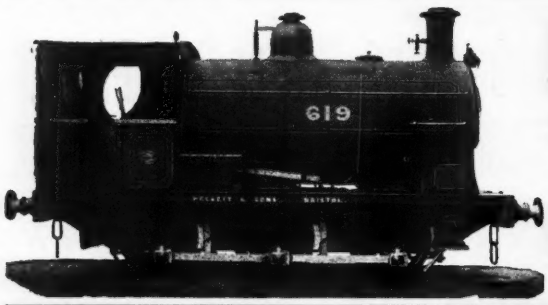
CROSSLEY'S "OTTO" GAS-ENGINES

Greatly Reduced Prices.



REPRESENTS NEW TYPE 40-HORSE POWER NOMINAL HIGH-SPEED ELECTRIC-LIGHT ENGINE.

CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER.



LOCOMOTIVES

LOCOMOTIVES of all Sizes and Gauges specially constructed for Main and Branch Lines, Contractors, Docks, Gas-Works, Collieries, Iron-Works, Brick and Cement Works, &c. Locomotives of various Sizes always in Stock, ready for Immediate Delivery.

Photographs, Specifications, and Prices on Application.

PECKETT & SONS, Atlas Locomotive Works, **BRISTOL.**

Telegraphic Address: "PECKETT, BRISTOL."

NEWTON, CHAMBERS, & CO.,

LIMITED,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD.

Established 1790

LONDON OFFICE: **19, Great George Street, WESTMINSTER.**

Telegraphic Addresses: "NEWTON, SHEFFIELD," "ACCOLADE, LONDON."

GAS ENGINEERS, IRONFOUNDERS, & CONTRACTORS.

Manufacturers of every description of

PLANT, APPARATUS, and MACHINERY for GAS and CHEMICAL WORKS.

RETORTS and FITTINGS, MOUTHPIECES with Self-Sealing Lids.

Improved COAL and COKE HANDLING PLANT, CONVEYORS, and ELEVATORS,

CONDENSERS, SCRUBBERS, and WASHERS.

PURIFIERS with Planed Joints a Speciality.

Patent CENTRE-VALVES, RACK and SCREW VALVES, WOOD GRIDS, and SCRUBBER-BOARDS, CAST-IRON MAINS, and SPECIALS.

STRUCTURAL WORK, COLUMNS, GIRDERS, and ROOFING.

GASHOLDERS, Cast-Iron or Steel Tanks.

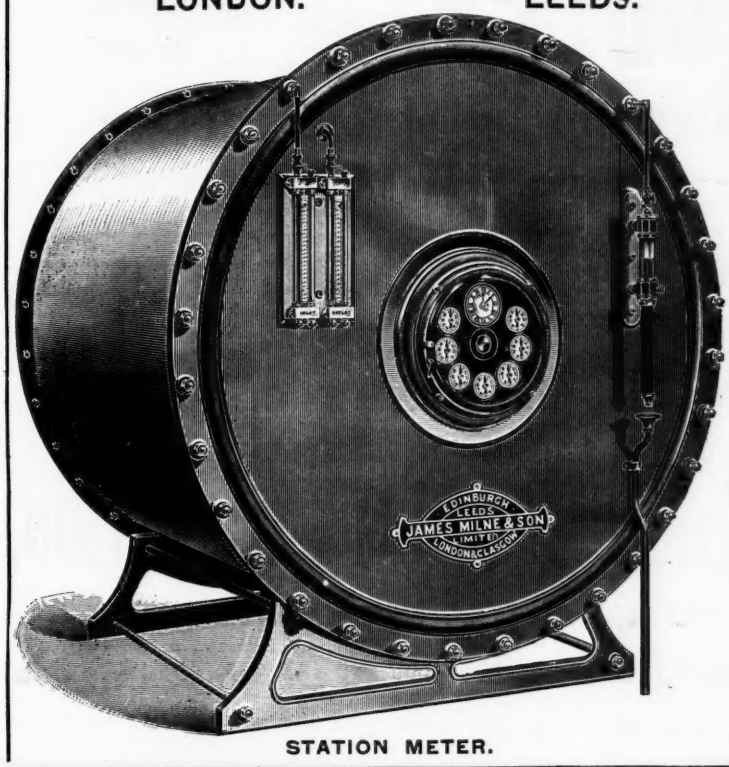
DESIGNS, SPECIFICATIONS, and ESTIMATES FREE.

PIG IRON (Special Quality) for Engine Cylinders. GAS COAL famous for its UNRIVALLED EXCELLENCE.

JAMES MILNE & SON, LTD.,

MILTON HOUSE WORKS, EDINBURGH.

60, HOLBORN VIADUCT, LONDON. 48, WELLINGTON STREET, LEEDS. 111, ST. VINCENT STREET, GLASGOW.



STATION METER.

CONSUMERS' WET AND DRY GAS-METERS.

PREPAYMENT METERS.

GOVERNORS.

VALVES.

ENGINES & EXHAUSTERS.

PRESSURE-GAUGES.

GAS FITTINGS AND BURNERS.

S. CUTLER AND SONS, MILLWALL, LONDON.

CARBURETTED WATER-GAS PLANT.

ADOPTED AT

HORNSEY.	BUENOS AYRES.	BEXHILL.
HASTINGS.	SOUTHALL.	SECOND ORDERS.
SOUTHEND.	PLYMOUTH.	SOUTHEND.
FOLKESTONE.	HARROW.	PLYMOUTH.

GASHOLDERS

OF EVERY SIZE AND DESCRIPTION.

CUTLER'S PATENT GUIDE-FRAMING FOR GASHOLDERS

HAS BEEN ADOPTED FOR MANY IMPORTANT HOLDERS.

IT IS STRONG AND CHEAP, AND REQUIRES NO PIERS FOR ITS SUPPORT

GIBBONS BROTHERS, LIMITED,

Telegraphic Address: "GIBBONS, DUDLEY."

DUDLEY,

Telephone No. 8013.

GAS ENGINEERS, CONTRACTORS, RETORT SETTERS.

Patent REGENERATIVE SETTINGS,

GIBBONS & MASTERS' PATENT No. 1269, 1893.

SUITABLE FOR WORKS OF EVERY CAPACITY,

AND A SPECIAL FORM OF WHICH IS APPLICABLE TO

GASEOUS FIRING WITH A MINIMUM EXCAVATION.

RETORT-BENCH IRONWORK, CONDENSERS,

SCRUBBERS, PURIFIERS, VALVES, &c.

DESIGNS AND ESTIMATES ON APPLICATION.

THE

MAXIM PATENT CARBURETTOR

FOR ENRICHING GAS IN BULK.

OVER 60 MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.

Among the Companies supplied are The Gas Light and Coke Company, The South Metropolitan Gas Company, Birmingham Corporation, Manchester Corporation, Rochdale Corporation, Bristol Gas Company, and many other Works, both large and small, where they have been working in some instances for the past **Seven Years.**

MORE GAS & SALEABLE COKE PER TON of COAL CARBONIZED is PRODUCED; SAVING CAPITAL, LABOUR, FUEL, WEAR & TEAR, &c.

THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

SOLE AGENTS FOR REDWOOD & CLOWES' INFLAMMABLE VAPOUR & GAS DETECTORS.

Dealers in Carburine and all other Naphthas and Oils suitable for the Enrichment of Gas.

For Prices and full Particulars, apply to

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

INCANDESCENT GAS-LIGHT

(WELSBACH PATENTS).

REDUCTION IN PRICES.

From the 1st of June, 1898, the following REDUCED PRICES will take effect:—

"C" Burner, complete	**5/-**
"C" Bye-Pass Burner, complete .	**6/6**
"Gem" Burner, complete . . .	**3/6**
"Gem" Bye-Pass Burner, complete	**5/-**
"C" Mantles **"Gem" Mantles**	**1/-**

PROPORTIONATE REDUCTION OF PRICES IN ALL PATTERNS.

Great Reduction in Chimneys, Globes, &c.

New Price List on application to

The Welsbach Incandescent Gas-Light Co., Ltd.

Palmer Street & York Street,

WESTMINSTER, LONDON, S.W.

TELEGRAMS: "FIRECLAY," LEEDS. TELEPHONE No. 612.

COAL and COKE Breakers, Elevators, AND Conveyors.

RETORTS, Bricks, Blocks, Tiles, &c.

ENGINEERS IRONFOUNDERS CONTRACTORS MANUFACTURERS

EVERY DESCRIPTION OF

RETORT SETTINGS AND IRONWORK.

WE GUARANTEE RESULTS.

BUILDINGS, ROOFS.

RE-SETTING RETORTS.

We desire to call attention to our SHALLOW REGENERATIVE SETTINGS, which are comparatively inexpensive to erect, and productive of excellent results. They are specially designed to suit those Retort Houses where for various reasons it is undesirable to excavate to any great depth.

We shall be pleased to furnish Designs and Estimates on application.

THE LEEDS FIRECLAY CO. LTD., ENGINEERING DEPARTMENT, WORTLEY, nr. LEEDS.

THE "TRAFALGAR"

PREPAYMENT GAS-METER

FOR PENCE, SHILLINGS, OR ANY COINAGE.

THE ADVANTAGES OF THIS SYSTEM ARE:

1. Simplicity of Mechanism.
2. Absolute Accuracy.
3. Impossibility of being tampered with.
4. Unaffected by irregularities in shape or thickness of the penny.
5. Can be fixed to any ordinary Wet or Dry Meter.
6. Extra large Money-Box.
7. Price Changer can be altered without otherwise disturbing the Meter.
8. Index showing number of Pennies in the mechanism at any time.
9. Rejection of Half-Pennies certain.

GUARANTEED FOR FIVE YEARS.

FRANK WRIGHT'S PREPAYMENT GAS-METER CORPORATION, Limited,

Telegraphic Address: "Gasometer, London." Manufacturers of Wet and Dry Gas-Meters. Offices and Works: 62, GLENGALL ROAD, S.E. Telephone No. 59 Peckham.

RETORT-SETTINGS
REGENERATOR.
GENERATOR.
FLOOR-LEVEL
GASEOUS SETTINGS.

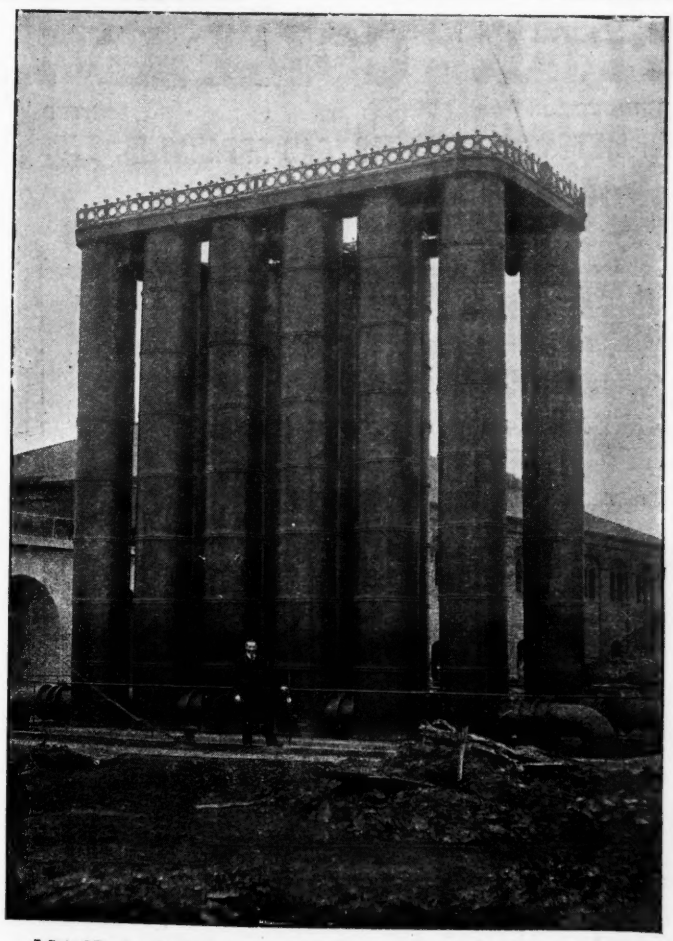
GASHOLDER TANKS
BRICK & PUDDLE, OR
CEMENT RENDERED.
ALL SIZES.

MAIN LAYING
GAS & WATER FROM
MINIMUM TO
MAXIMUM SIZES.

J. & H. ROBUS,

ENGINEERING CONTRACTORS FOR
GAS & WATER WORK OF EVERY DESCRIPTION,

20, BUCKLERSBURY, LONDON, E.C.



A Set of Twelve Condensers, 3 ft. 6 in. diameter by 30 ft. high. *From a Photograph.*

W. C. HOLMES & Co.

MAKERS OF

Retort Ironwork, Patent Scrubber-Washers,
Purifiers, Gasholders of all Sizes,

AND

Gas Plant and Structural Ironwork of every description.

CATALOGUES SENT POST FREE
ON APPLICATION.

Whitestone Iron-Works,
HUDDERSFIELD.

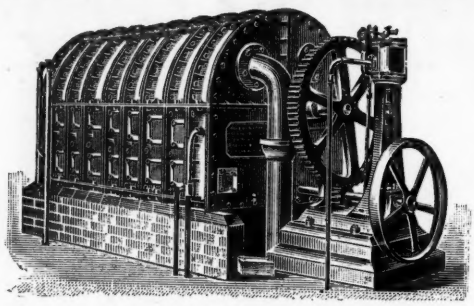
Telegrams: "Holmes, Huddersfield;" "Ignitor, London."

KIRKHAM, HULETT, & CHANDLER, LD.

3 & 4, PALACE CHAMBERS, BRIDGE STREET, WESTMINSTER, S.W.

PATENT "STANDARD" WASHER-SCRUBBER.

This Apparatus upholds its title, the "STANDARD;" being recognized by leading Engineers as the most efficient Apparatus for the Extraction of Ammonia from Coal or other Gases.



After a trial with two of these Machines, one Corporation has given a further Order for **16**, each for 3,500,000 Cubic Feet of Gas per day.

Number of Patent "STANDARD" Washer-Scrubbers in use at this date

560

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

Midland District Office: PRINCE'S CHAMBERS, 6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.

TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE No. 200.

London District Office: 6, STRAND, LONDON—C. PARKER & SON, Sole Agents.

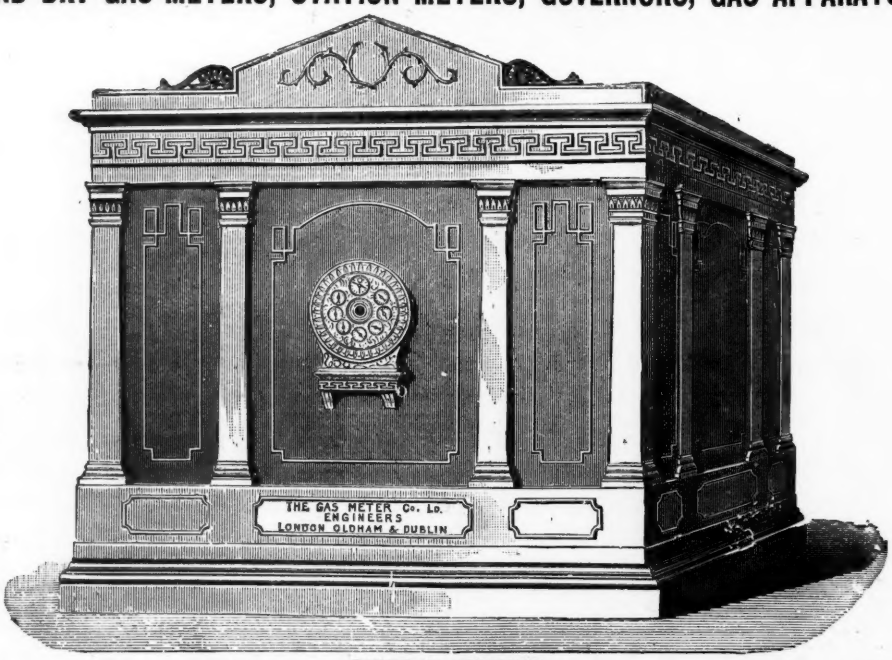
TELEGRAPHIC ADDRESS: "PARKER, LONDON."

THE GAS-METER COMPANY, LIMITED

MANUFACTURERS OF

WET AND DRY GAS-METERS, STATION METERS, GOVERNORS, GAS APPARATUS, ETC.

SQUARE STATION METERS WITH PLANED JOINTS.



STATION METERS IN CYLINDRICAL CASES.

DESIGN No. 2 PATTERN.

STATION METERS MADE AT THE COMPANY'S WORKS, OLDHAM, LATE WEST & GREGSON. Established 1830.

For Prices and Particulars apply to

R. L. ANDREWS, General Manager.

Works: 238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

Telegraphic Address: "METER."

[See Advertisement on back of Wrapper.

ALEX. C. HUMPHREYS, M.Inst.C.E. A. G. GLASGOW, M.E.

SINCE 1893

MESSRS. HUMPHREYS & GLASGOW

Have constructed or have in hand

CARBURETTED WATER-GAS PLANT

FOR THE FOLLOWING UNDERTAKINGS:—

	Cub. Ft. Daily.		Cub. Ft. Daily.
Copenhagen	700,000	Edinburgh	2,000,000
Belfast	1,700,000	Guildford	350,000
Belfast (Second Contract)	4,500,000	Stockton-on-Tees	500,000
Brussels	700,000	Syracuse, N.Y.	850,000
Brussels (Second Contract)	700,000	Brentford	1,200,000
Liverpool	3,500,000	Commercial Gas Co.	850,000
Liverpool (Second Contract)	4,500,000	Commercial Gas Co. (Second Contract)	850,000
Tottenham	750,000	Commercial Gas Co. (Third Contract)	1,250,000
Tottenham (Second Contract)	750,000	Bridlington	125,000
Santiago	400,000	Middlesbrough	1,250,000
Swansea	750,000	Croydon	1,250,000
Manchester	3,000,000	L. & N.W. Railway, Crewe	700,000
Brighton	1,750,000	Taunton	225,000
Preston	1,500,000	Lawrence, Mass.	400,000
New York	1,200,000	Rotterdam	850,000
Southport	750,000	Dorking	125,000
Bath	1,000,000	McKeesport, Pa.	500,000
Newburgh, N.Y.	350,000	The Gaslight and Coke Co., Bromley	3,750,000
Newburgh, N.Y. (Second Contract)	250,000	The Gaslight and Coke Co., Nine Elms	2,750,000
Hoylake	125,000	Durham	200,000
Coventry	600,000	New York (Remodelled)	11,000,000
Coventry (Second Contract)	600,000	Scarborough	800,000
Bordentown, N.J.	125,000	Perth, W.A.	125,000
Winchester	200,000	Bremen	550,000
Shanghai	225,000	Maidenhead	225,000
Stockport	500,000	Epsom	225,000
Norwich	1,000,000	North Middlesex	150,000
Holyoke, Mass.	600,000	Wandsworth and Putney	1,800,000
St. Joseph, Mo.	750,000	Aarhus	800,000
Lea Bridge	350,000	Falmouth	150,000
Lea Bridge (Second Contract)	350,000		

In addition to which the 1891 Installations of The Gaslight and Coke Company, on the Humphreys' Double-Superheater System, have a capacity of 12,000,000 Cubic Feet per diem.

IN THE UNITED STATES,

Messrs. Humphreys and Glasgow and The United Gas Improvement Company have jointly constructed **278** Sets of Humphreys' Double-Superheater Apparatus; **157** of these since **1893.** This Company (of which Mr. Humphreys was formerly Chief Engineer) was, until lately, the largest Contractor for Carburetted Water-Gas Apparatus in the World.

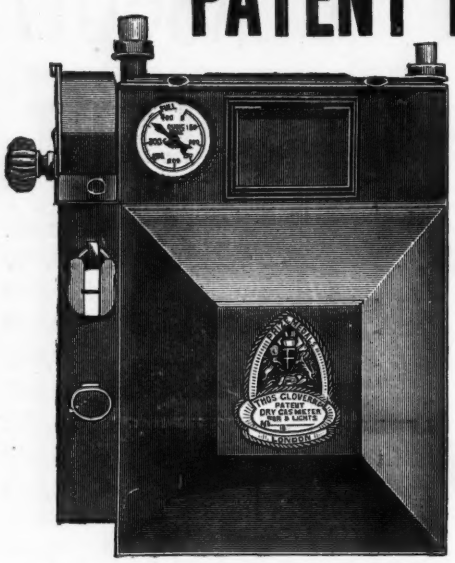
MESSRS. HUMPHREYS & GLASGOW, OF LONDON, NOW HOLD THAT POSITION.

9, VICTORIA STREET, LONDON, S.W.
Telegrams: "EPISTOLARY, LONDON."

UNITED STATES OFFICE:
BANK OF COMMERCE BUILDING, NEW YORK.

THOMAS GLOVER & CO.'S

PATENT NEW IMPROVED PREPAYMENT METER



For Pennies, Shillings, or any Coin.

Simple in Mechanism.
Positive in Results.
Price Changer *in Situ.*

GUARANTEED FOR FIVE YEARS.

Telegraphic Address: "GOTHIC, LONDON." Telephone No. 725 Holborn.

THOMAS GLOVER & CO., LTD.,

DRY GAS-METER MANUFACTURERS,

214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

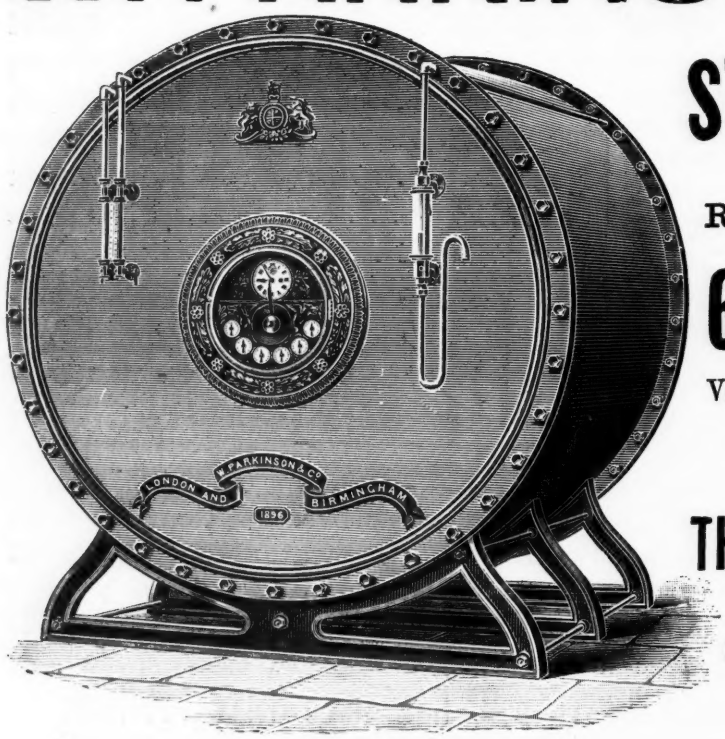
BRISTOL: 28, BATH STREET. *Telegraphic Address:* "GOTHIC." Telephone No. 1005.

BIRMINGHAM: 1, OOZELLS STREET. *Telegraphic Address:* "GOTHIC."

MANCHESTER: 37, BLACKFRIARS STREET. *Telegraphic Address:* "GOTHIC." Telephone No. 3898.

GLASGOW: ARGYLE WORKS, KINNING PARK. *Telegraphic Address:* "GASMAIN." Telephone No. 1523 South Side.

W. PARKINSON & Co



STATION METERS

IN

ROUND or SQUARE TANKS.

OVER

600 STATION METERS,

Varying in size from **1200** to **250,000** cubic feet per hour, have been sold fitted with

THREE-PARTITION DRUMS.

DURABILITY UNEQUALLED. SOME HAVE BEEN IN CONSTANT USE FOR OVER 60 YEARS.

COTTAGE LANE WORKS, CITY ROAD,
LONDON.
Telegraphic Address: "INDEX." Telephone No. 778 King's Cross.

BELL BARN ROAD WORKS,
BIRMINGHAM.
Telegraphic Address: "GAS-METERS." Telephone No. 1101.

[See also Advt. p. 1420.

CONTENTS.

EDITORIAL NOTES:— PAGE

GAS, LIGHTING, &c.—
Formation of a New Gas Companies' Association 1365
Rejection of the Suggested New Clause in The Gaslight and Coke Company's Bill 1365
The "Builder" on the Gas Industry 1366
The Protection of Industrial Property 1366
The Trouble of South Wales 1366
Damages against a Trade Union Official—Payable in 219 Years . 1367

WATER AND SANITARY AFFAIRS—
The Local Government Board and their "Protection of Sources of Water Supply" Clauses 1367
The Metropolitan Water Inquiry 1367
The Artesian Well of the Corporation of London 1368

INSTITUTION OF GAS ENGINEERS:—

GENERAL MEETING IN LONDON—
Inaugural Address of Mr. G. E. Stevenson, M.Inst.C.E. . . . 1368

ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market 1373
Electric Lighting Memoranda 1373
Precursors of the New Welsbach Burner 1373
Discovery of Natural Gas in Sussex 1374
Purification of Acetylene 1375

COMMUNICATED ARTICLES:—
Photometric Standards. By W. Grafton, F.C.S. 1377
The Three-Lift Gasholder at Sutton, with Remarks on Construction. By F. S. Cripps, Assoc.M.Inst.C.E. 1378

TECHNICAL RECORD:—
Society of Chemical Industry—Professor Lewes on Acetylene Generators 1379
Acetylene Generators 1380
Society of Engineers—Discussion on Mr. E. A. Harman's Paper on "Gas-Works Machinery" 1382
The Decomposition of Gas Oils, Phenols, and Creosote by Heat. 1384
British Association of Water-Works Engineers—Mr. R. E. W. Berrington on the Sources of Town Supplies 1386
The Use of Breeze as Boiler Fuel 1387

CORRESPONDENCE:—
The Accident Fund of the South Metropolitan Gas Company. . 1388
Workmen's Compensation Insurance 1388
The Workmen's Compensation Act 1388
The Temperature of Gas Measurement 1389
Foundations 1389

PARLIAMENTARY INTELLIGENCE:—
House of Lords—Progress of Bills 1389
House of Commons—Progress of Bills; The Rating of Reservoirs; The Gaslight and Coke Company Bill 1389
House of Commons Committees—
Brompton, Chatham, Gillingham, and Rochester Water Bill . 1391
Southend Water Bill 1392
Matlock Urban District Council Bill 1393

LEGAL INTELLIGENCE:—
Claim for a Gas-Meter 1394
Conviction for Stealing Gas 1394

MISCELLANEOUS:—
The New Gas Companies' Association 1394
Water Gas in the Garston District 1396
Wigan Corporation Gas Supply—Gas Engineer's Annual Report. 1396
Gas and Electric Lighting at Burton-on-Trent 1396
The Hours of Labour at the Dewsbury Gas-Works 1397
Perth Corporation Gas Supply—The Annual Accounts . . . 1397
Dundee Corporation Gas and Electricity Supply 1397
St. Helens Corporation Gas Supply—Annual Financial Statement 1398
Coventry Corporation Gas Supply—Annual Report 1398
Public Lighting at Plymouth 1398
Electric Lighting Notes 1399
Accrington Gas and Water Board 1399
Sales of Stocks and Shares 1399
Metropolitan Water Supply Commission—Twenty-fourth Day . 1400
Bradford Corporation Nidd Valley Water-Works 1402
Notes from Scotland 1402
Current Sales of Gas Products 1403
Gas and Water Companies' Stock and Share List 1404
Coal Trade Reports 1405

PARAGRAPHS:—
PERSONAL: Mr. S. Barlow; Mr. John Methven; Mr. S. Crossland; Mr. F. P. Tarratt; Mr. James M'Cubbin; Mr. Walter Grafton; Mr. B. A. Lewis. 1376
OBITUARY: Sir Robert Rawlinson; Hon. Henry Lewis Noel; Mr. Daniel M'Cullum 1376
Transactions of the Institution of Gas Engineers for 1897—The North of England Gas Association and Workmen's Compensation Insurance—Calcium Carbide from Basic Slag. . . . 1372
Another Use for Street-Lamps 1374
The Effect of Electrical Apparatus in an Explosive Atmosphere. 1376
The Density of Liquid Hydrogen—Dr. Klein on Bacteriology—Discovery of Another New Constituent of the Atmosphere . . 1379
Patents in 1897 1381
The Wigston District Council and the Gas-Works—Extensions at the Usk Gas-Works—The Acquisition of the Amsterdam Gas-Works by the Municipality—The Cost of the Artesian Well Water Supply of the Corporation of London 1388
Wycombe Gas-Works Refuse Case—Middleton Gas Supply . . 1389
A Disappearing Kent River 1390
Incandescent Gas Lighting at Falmouth 1393
New Joint-Stock Companies 1394
The Bolton Corporation and Gas Traction 1397
The Proposed Purchase of the Ashburton Gas-Works—The Singapore Municipal Commissioners and the Gas-Works . . 1399
The Gas-Works Purchase Question at Wallingford—Suggested Supply of Gas at Cost Price 1401
The Public Lighting of Winchester—Meter and Burner Testing in Liverpool 1402
Ramsgate Corporation Gas and Water Supply—Neath Corporation Gas Supply 1405
Assessment of the Blyth and Cowpen Gas-Works—Stourbridge Gas Supply—Reductions in Price—The Halifax Gas Committee and the Workmen's Compensation Act—Tonbridge Water Company—The Boring for Coal in East Anglia—Increased Assessment of the Leeds Corporation Water-Mains—Sheffield Corporation Water Accounts 1406
A Simple Method of Settling an Assessment Dispute—Annual Meeting of the North Shields Water Company: The Purchase Question 1407

EDITORIAL NOTES.

Formation of a New Gas Companies' Association.

THE meeting of representatives of Gas Companies convened on Tuesday at the Westminster Palace Hotel to consider the proposed resuscitation of the Gas Companies' Association, or the formation of a somewhat similar organization, was well attended by a number of gentlemen connected with many important gas undertakings. Mr. George Livesey took the chair; and the proceedings, which were of an interesting character, will be found reported in another column. The Chairman's introductory address explained the reasons that had actuated those who took the initiative in calling the meeting, and discussed some of the parliamentary projects of which a Gas Companies' Association would naturally take cognizance. This brief statement, slight as it was in substance, may be regarded as fully proving the case for the contemplated organization. For it is incontestable that a great deal of parliamentary effort is now directed to hampering the freedom of industries of all kinds, and that some of these projects of legislation are of so insidious a character as to deceive the public in regard to their motive and intention. It is therefore highly desirable that the defence of the threatened interests should be as well prepared as the attack, which can only be done by those whose legitimate interests are imperilled uniting for the purpose under intelligent direction. It is part of the proper work of the "JOURNAL" to warn the gas industry of the legislative perils that environ it session after session; and we have accordingly drawn attention in this column from time to time to all the vexatious Bills catalogued by Mr. Livesey as threatening Gas Companies together with other industrial and trading concerns. But when we have focussed criticism upon such a measure as, say, the Steam Engines and Boilers (Persons in Charge) Bill, what is the usual result? Although it is easy to show that the passing of such a measure would injuriously affect every gas undertaking of any importance in the land, gas proprietors as such are not represented in any defensive operations that may be undertaken with the object of preventing the passing of the Bill. Consequently, the interests of a vast industry may be at the hazard of the members' ballot and the other accidental circumstances that sometimes favour the course of private members' Bills.

Mr. E. C. Cooper further explained to the meeting that the concrete experience this session of the Swansea Gas Company had been instrumental in precipitating the vague aspirations after some fresh scheme of defensive union that had been floating about among followers of the gas industry in these kingdoms ever since the dying down of the old Association. Mr. Howard Charles Ward, as Chairman of the old Association, gave his blessing to the movement for forming a new one; and at the same time he took care to acknowledge the value of the services rendered to the Association by Mr. William Livesey. To Mr. Ward was fittingly confided the duty of moving the resolution declaring the expediency of constituting an Association of British Gas Undertakings, which found a seconder in Alderman Hart, of Canterbury. The executive resolution creating a Provisional Committee "for the purpose of preparing rules "for the management of the Association, and for arrang-"ing all preliminary matters connected with the formation "thereof," was proposed by Mr. Thornton Andrews, of Swansea. A strong Committee was then nominated, with Mr. E. Campbell Cooper as Hon. Secretary *pro tem.* If the movement comes to anything and proves useful—of which there ought not to be any doubt—the credit of it must be given to Mr. Thornton Andrews, who is the real father of the new Association. Permanent success can only be assured, as Mr. Andrews hinted, if the traditional apathy of Gas Companies as regards all but their own immediate and individual risks is abandoned for an active sense of the value of combined action in their own defence.

Rejection of the Suggested New Clause in The Gaslight and Coke Company's Bill.

THE adjourned order for the consideration of The Gaslight and Coke Company's Bill, as amended, occupied the attention of the House of Commons for some time on Thursday afternoon. Mr. Pickersgill moved his new clause, the bearings of which have already been discussed in the "JOURNAL;" and he asked the House to throw over the sliding-scale, and also to overrule the decision of the Committee who passed the preamble of the Bill. This attack

brought up Mr. Johnson-Ferguson, the Chairman of the Committee, who explained that under the Bill the Company would not be able to levy one penny extra charge upon the consumers or to pay the shareholders one extra penny dividend. He then went on to show that the only valid criticism of the measure offered by Mr. Pickersgill—that by the process of stock conversion to be effected under the Bill the actual amount of the capital expended upon the undertaking would be concealed—had been met by the communication made by the Committee to the Board of Trade with respect to the form in which the statutory accounts of the Company are to appear. Mr. Pickersgill and his followers found themselves in the awkward predicament of being opposed not merely to the doings and desires of a particular Gas Company, but also to the Private Bill procedure of the House. One of the party —ex-Professor Stuart—engagingly told the Committee and their Chairman that they had failed to "realize "the point" upon which he and his friends were desirous of taking the sense of the House. This is a remarkably good example of the modesty and courtesy which makes "professors," and the spokesmen of the London County Council generally, so popular in Parliament. Unfortunately for their cause, however, these gentlemen could not show that there was any fresh matter in the case that they wished to make out against the Bill. Such as it was, the whole argument had been heard by the Select Committee, who had formed their opinion of it. Hence it was no longer the promoters of this particular Bill who were impeached by Mr. Pickersgill, but also the whole parliamentary system of dealing with Private Bill legislation. It was upon the latter ground that the President of the Board of Trade met the opposition. He had not a word to say for the Company, but merely contended that if the House were to take upon itself the functions of its private Committees, it would be accepting responsibilities it could not adequately discharge. This settled the fate of the Bill, which was ordered for third reading after a division in which the authority of the Committee was supported by a majority of 105. This is the true meaning of the vote. The House is not disposed to do anything to destroy the authority of its Committees. The decisions of Committees are occasionally reversed; but it is tolerably safe to say that this only happens when the House is convinced that the Committee had not the whole case before them. A significant incident of Thursday's debate was the repetition of Mr. Ritchie's invitation to Mr. Pickersgill to "put "a motion on the paper for a Committee" to inquire into the whole matter of the gas supply of North London. The President of the Board of Trade offered that in this event he would consider whether anything could be done after having seen the terms of the notice. "Beyond that it was "impossible for him to go." Mr. Pickersgill, by all accounts, did not give any indication of an eager desire to take up this challenge; and accordingly the matter rests with the emergence of the Bill from the tender mercies of the House and its Committee. The Bill passed its third reading yesterday afternoon.

The "Builder" on the Gas Industry.

In the "Builder" for the 4th inst. there appears in the foremost place an editorial appreciation of the gas industry which deserves recognition as an honest attempt to acquaint the followers of one great industry with the character and the extent of the doings of another. It is a frequent complaint among gas managers that the general public do not understand the importance of the part played by gas in modern civilization; but it is quite commonly found that, in this highly specialized world, the members of the different callings, even of educated men, are wofully ignorant of the bearings of each other's occupations. Our contemporary is therefore deserving of praise for devoting a large portion of its space to an intelligent presentment of the circumstances of an industry with which architects and builders have many points of contact. These relations are not likely to be terminated yet awhile, for, as the writer of the article recognizes, "it is a peculiarity of "modern times that the demand for more artificial light "has steadily increased, and although the lighting of "both streets and dwellings has continually improved "during the present century, yet the demand shows no indi-"cation of abatement." The writer further says that, in point of fact, "a gas consumer who adopts a burner which "gives double the lighting value, but consumes only the "same quantity of gas as the discarded burner, usually "takes advantage of the increased light in preference "to reducing the gas bill; and the ever-increasing bril-"liancy of shop lighting is evidence that effective light-"ing is an attraction to customers." It is the opinion of our judicious contemporary that "it is more than probable "that the gas industry will continue to flourish, in spite of "the growth of its rival industries, for many generations "to come." This being so, it would be as well if architects and house builders generally would pay a little more attention than they usually do to the fittings and arrangements of interiors for the effective, economical, and decorative use of this universal servant of the community, for all the purposes it is found to subserve in town life.

The Protection of Industrial Property.

A Congress of the International Association for the Protection of Industrial Property has been held at the Society of Arts, under the presidency of Sir Henry Roscoe. The object of the Association, which is only two years old, appears to be to develop the international protection of patents, trade marks, designs, and similar forms of property, by holding congresses for the discussion of existing treaties and systems of law and formulating suggestions for reform. There is plenty of room and need for work of this kind. Modern material civilization is universal; but the laws for its encouragement and protection are otherwise. When a man, by his genius, perseverance, and the successful devotion of himself and his resources of all kinds to a particular purpose, has enriched the world with a new description of property, the small proportion of the value of it that the most generous law reserves to himself is exposed to risk of robbery in many ways. The neighbourliness of nations is never more conspicuous than when a patent granted by one is being wrecked commercially by all the others. It is recognized by all civilized nations that security for property is the foundation of prosperity and progress; but they differ widely in the quality and extent of the protection they afford to the most fruitful of all kinds of property. He who acquires a plot of land almost anywhere on the earth's surface can command all the forces of civilization to protect his enjoyment of his possession. But another man, whose property is in the form of ideas possibly more fruitful of benefit for the race than any stretch of soil in the world, receives very different treatment. At the Congress many suggestive criticisms of existing patent laws and conditions of protection were offered and discussed. Scarcely one of the features of the different patent laws of various countries escaped examination, sometimes pointing to condemnation. The participants in these discussions were, as a rule, experts in their respective lines, and their observations possess exceptional value. It were to be devoutly wished that the smatterers who write to the newspapers occasionally on questions of patent law and practice could be first taken through the proceedings of the Congress; for many a crude suggestion would be saved thereby. But it is the way of the world for the people who have most to learn from publications of this kind to ignore them. We may have to return to the transactions of the Congress at some future time.

The Trouble of South Wales.

Another week has passed without bringing peace to the distracted South Wales coalfield. It was quite hoped and believed that, when the miners' representatives, entrusted at length with plenary powers, met the other side in conference over the points at issue, an agreement would be speedily arrived at. This confident expectation has been disappointed. A conference duly took place as soon as possible after the men's delegates had received their authority to act; but it proved abortive, for the reason that the delegates merely made use of the meeting as a means of facing the employers with a cut-and-dried demand for a 10 per cent. immediate advance, and for the appointment of a Board of Conciliation—really a Wages Board—with an ultimate reference to an Umpire. They were told again, as they had been told before (we follow the account given of these proceedings by "The Times" Special Correspondent), that the employers could not, and would not, grant the advance of 10 per cent., and would not entertain the suggestion of a Board of Conciliation with an outside Umpire. For their part, the employers declared that the pits were still open to applicants for work on the terms of April 11, which would give an immediate advance of $3\frac{3}{4}$ per cent. There was no real desire on either side to meet the other; and the conference broke

up without anything of the nature of compromise being even hinted at.

Another meeting was held in Cardiff last Saturday; Sir W. T. Lewis presiding and Mr. W. Abraham being in the vice-chair. The differences between the two sides were again exhaustively discussed; the men adhering to their demand for a Conciliation Board, with an Umpire; while the employers offered the alternative of a permanent Joint Board, consisting of an equal number of employers and employed, to carry into effect a new sliding-scale of wages and coal prices. Asked why they objected to the latter proposal, the workmen's representatives declared that the Conciliation Board would be able to take into consideration other circumstances affecting the standard of wages besides the mere selling price of coal. The parties were unable to advance from their respective positions; and again the conference broke up without having effected anything tending towards a settlement. The case is therefore one of growing seriousness. The usual misrepresentations of the issues are being offered for popular consumption by the newspapers which pander to the supposed cause of "Labour" against "Capital." The difference between the employers and the men is declared to be trifling, so that only the obstinacy of the former stands in the way of a settlement. In reality, the cause at stake is of the first importance; being nothing less than that of who is to be master of the business. Miners are accustomed to band together for work; and the strikers are massing for the purpose of marching in procession with the object of terrorizing their fellows who remain at work. Magistrates have been stoned, and policemen injured. Extensive rioting is feared; and it will be more than it now seems reasonable to hope for, if another week passes without bloodshed. Another sacrifice to the fetish of Socialistic Trade Unionism!

Damages against a Trade Union Official—Payable in 219 Years.

Everybody knows Mr. Bumble's opinion of the law. It is to be feared that if this immortal representative of the civil power were to be made acquainted with the upshot of some recent proceedings in the Bloomsbury County Court, holden not far from his own accustomed haunts, he would not think the law improved since his day. It was a case in which a firm of fibrous plaster manufacturers applied for judgment against a man described as the Secretary of the Plasterers' Union, for an amount determined by the High Court. Counsel for the plaintiff stated that the claim arose out of a strike in the trade to which the parties belonged. Owing to the action taken by defendant and his Union, the firm were obliged to commence proceedings against him for libel. They obtained a verdict for £500 damages for the libel, £300 for inducing other firms to break their contracts with them, and the costs amounted to £254. Defendant, in answer to his Honour, said he was "Organizing Secretary to the Plasterers' Union, but "might be discharged at any time at a month's notice. "He received £2 5s. a week." He was a Guardian of the Poor for North St. Pancras. The result is succinctly reported as follows: "Judge Bacon—8s. monthly. (As "the amount of the judgment and costs is £1054, it will "take 219 years to liquidate it at this rate, the last instal-"ment falling due in December, 2117.)" Nobody but Bumble could be trusted to fittingly comment upon this judicial farce. A Trade Union Secretary with command of the war-chest of the Union, carries on a campaign of violence and vituperation against a commercial firm, who, if they were to venture to employ similar forces in their own defence, would be severely called to account. They rely upon the law for their remedy; and this is what they get. Truly, in this favoured land, there is one law for the "rich" and another for the "poor."

WATER AND SANITARY AFFAIRS.

We understand that the clauses proposed by the Local Government Board for "the protection of sources of water "supply," and which were printed *in extenso* in the "Journal" for the 31st ult. (p. 1271), will be moved in the House of Commons, by Mr. Chaplin, on Thursday next, instead of the date previously named; and we cannot help thinking that a more lamentable exhibition of the weakness of the Local Government Board in dealing with a most important question has rarely, if ever, been witnessed. In the first instance, the Local Government Board endeavoured to introduce clauses very similar to these in the House of Lords; but they seem to have failed to convince Lord Morley that it would be in accordance with the usual practice of Parliament to amend the Water-Works Clauses Act by Private Bills. Mr. Chaplin, however, appears to take a different view, and wishes—by the insertion of the clauses in question in the Higham and Hundred of Hoo and Mid-Kent Water Bills—to create a precedent, in an *ex parte* manner, which will hereafter be made to apply to all Water Authorities and Companies as they happen to come before Parliament as promoters of Private Bills. It would be difficult to form an opinion as to the length of time, under this gradual process, that it would take to make the provisions of the clauses applicable to the whole of England.

If any amendments of the Water-Works Clauses Act are desirable in the direction indicated, what possible reason can be suggested why they should not be brought before Parliament in the regular way—viz., by a Public Bill, which would, of course, be fully discussed in Committee in the House, and the views of all the different interests affected considered? Another objection to the proposed clauses is that they seem entirely to miss the mark, while providing means of affording endless trouble and annoyance to Water Authorities. Under the second clause, "Power to Take Samples of Water" *any* water consumer (which means *every*) may at any time, on giving six hours' notice, enter upon any lands and premises of the Water Authority for the purpose of taking samples of water. If such a provision as this were to become law, it might be necessary to keep a large staff of assistants for the express purpose of accompanying the sample-takers. Then of what practical use is the proposed power? for on what part of the Water Authority's premises can a sample of the water supplied be taken to such advantage as at the tap on the consumer's own premises, and it requires no Act of Parliament to enable him to take it there.

The proposed clauses relating to "Pollution of Water "Supply" tend more in the necessary direction. Clause 1, enabling any Medical Officer of Health or Officer of the Water Authority to enter on land or premises from which water is obtained or supplied, to take samples of water, matter, substance, or liquid, which may appear likely to cause pollution, is a useful provision so far it goes, as under it, in case of pollution, no doubt the source might be ascertained. But that is all. No powers are proposed to be conferred on the Medical Officer of Health and the Water Authority to enable them to stop the pollution; nor is it even suggested, in the case of a Water Company, to give the Company power to put in force the provisions of the Rivers Pollution Act should the Sanitary Authority fail to do so. The question of pollution of water supplies is of great importance not only to water consumers throughout the country, but also to those supplying water, and ought to be thoroughly gone into by the Local Government Board after full inquiry; but the attempt now made to deal with the matter in the dribbling fashion suggested, is unworthy of a great public department.

There is a little difficulty in understanding some portions of Sir Alexander Binnie's evidence, as given before the Royal Commission last week. Certain passages seem clear enough until they are confronted with others. The replies given to Major-General Scott were in several instances very explicit. Thus it was explained that the arrangements for cutting off portions of the water-works were concessions proposed to be made by the County Council in deference to the wishes of the Outside Authorities. But Sir A. Binnie, speaking for himself, said that "all through "these negotiations" he had felt that separation would be "inconvenient and extravagant," and that those Authorities, if they saw what it would cost, would prefer to cast the responsibility upon the County Council, or whatever might be the newly-constituted Authority, the water being supplied in bulk. This, Sir A. Binnie considered would be the most economical plan, the outer districts avoiding all capital expenditure, except that for distribution pipes. On this view of the question, we would ask: Why make any change at all? The water will flow as before; but the Outside Authorities will have to purchase the pipes which have been laid in their several districts, and will pay for the supply that is sent in, themselves collecting the water-rates from the consumers. Why this roundabout process? After all, it is virtually partitioning, only the mains will not be cut as they cross the boundaries. What possible good can arise from this, except to enable the County Council

to make peace with the Outside Authorities by giving them the semblance of independence. "Concessions" serve as the key-note still; it being well understood that the Outside Authorities have no desire to see the County Council rule over the water supply of their districts. On the other hand, the Council are perfectly content to let the outer areas go, and seemingly the Council would be well pleased for the Outside Authorities to possess their own sources of supply as well as their own distribution pipes. Sir A. Binnie says: "Essex, like the other counties, "wished to have control of its sources, as well as of the "means of distribution." All through the evidence given by him we meet with the notion that the water supply can be localized, not only in its delivery, but in respect to its sources. All round London there are to be little Water States, buying water wholesale from the Council, or looking it up for themselves. Actual partition, though costly, the witness thinks to be practicable as a feat of engineering; and how prettily this would work we gather when we find that the wells of the Kent Company would have to be partitioned between Kent and London. "In fact," says Sir A. Binnie, "London would have to buy in bulk from "Kent." The springs and wells of the New River Company would be taken over by the new Authority; and Hertfordshire would "get its supplies from local sources." All the works would be retained by the new Authority; but the latter is to be limited as to the quantity it is to receive through these works. To escape from this muddle, and much more of the same sort, Sir A. Binnie proposes "water in bulk;" and it is impossible to see who would be the better for it. It is amusing to find Mr. Pope saying to the witness, "I want to understand you;" and then adding: "If I follow the bent of your mind, it is that "the difficulties of partition would be so great that it is "a question of supply in bulk or not at all." At the close of the sitting, Mr. Pember raised a question not hitherto discussed—as to what view the War Office would take of the long conduit from Wales. The Chairman thought the subject was hardly within the limits of the reference. Yet it is a great practical question; and it would be interesting to have a good military opinion upon it.

At the time when the Corporation of London opened their artesian well for the purpose of supplying water to the artisans' dwellings which they had established in the neighbourhood of Stoney Lane, we remarked on the unprofitable nature of the undertaking; the New River Company being able, according to their ordinary scale of charge, to furnish a cheaper supply than could be obtained from the Corporation well. It was not, as we still find suggested, a question of testing an asserted monopoly; the civic Authorities being perfectly at liberty to sink a well and pump water to supply premises of their own, in the same way as a hotel keeper, or the owner of a brewery, may provide himself with an independent supply. But the enterprise was a very fair test of relative cheapness; and the result is shown in what some of the newspapers have proclaimed to be "A Costly Experiment." Before the well came into operation, the New River Company had been furnishing the artisans' dwellings in question with a constant supply of water for which the charge was £84 per annum. The Corporation, having taken the matter in hand, proceeded to expend £180 per annum in pumping, besides being burdened with a capital expenditure of £5610. The water raised is about 33,000 gallons per day, of which 22,000 gallons go to the artisans' dwellings; leaving a surplus of 11,000 gallons for which there is not any particular use. It might be applied to washing the streets; but the Corporation find that this would only make their balance-sheet so much the worse, and they have accordingly decided to let the matter alone. Putting the annual yield of the well at 12 million gallons, and valuing this at 9d. per 1000 gallons, the water might be considered worth £450. This is the most that can be said for it; and, as a matter of fact, no such money can be forthcoming—the Corporation having no power to sell. But taking this theoretical value, we have to set against it £180 for pumping, and an annual charge in respect to capital, which, put at a bare 5 per cent., raises the annual expenditure to £460—a sum which is clearly under the mark. Evidently there is no room for profit, and nothing available to produce a dividend for a joint-stock company, or to create a balance in aid of rates. Do we see in this a foreshadowing of the financial results to be expected, if the County Council are enabled to bring in their vaunted supply from Mid-Wales?

INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

ROYAL UNITED SERVICE INSTITUTION,

WHITEHALL, S.W.,

JUNE 14TH AND 15TH, 1898.

Mr. G. E. STEVENSON, M.Inst.C.E., President.

INAUGURAL ADDRESS.

Gentlemen,—It is with a profound sense of the honour you conferred upon me, by electing me your President this year, that I rise to address you this morning.

To-day the Institution meets again in the eighth year of its existence. Our numbers have increased year by year, and now exceed 200 members. Although still not a very large body, we represent a very important section of the gas industry of the United Kingdom. The gas undertakings represented by our home members manufacture some 83,000 million cubic feet of gas per annum; this being equal to 65½ per cent. of the total output in Great Britain and Ireland. We have also enrolled among our members the Engineers of some very important Continental and Colonial gas-works.

Though only eight years have elapsed since the Institution was incorporated and commenced its career, it has already accomplished much useful work. By papers and discussions at our meetings, the value of modern improvements in carbonizing plant, and in machinery connected therewith, has been emphasized. Special attention has been given to new methods of gas making, and to the recovery of additional bye-products resulting therefrom. A Special Sub-Committee of the Institution have carefully tested a proposed photometric standard, and determined its relative value. They have also studied the question of temperature as affecting the percentage of unaccounted-for gas, and approximately defined the lines upon which corrections for temperature should be made in the registration of the station-meter, in order to correspond with the temperature at which the gas is sold. The Institution has discussed the relationship of gas workers to their employers, and shown how, in one instance at any rate, a happy solution has been found for the difficulties that existed. The Institution has not confined its attention solely to the phases of gas-works management in Great Britain, but has sought acquaintance with the aspect of things on the Continent; visiting last autumn cities in Holland and Belgium, where the members received the greatest courtesy and kindness from their fellow Gas Engineers in those countries. The return visit of the Dutch Association of Gas Engineers to London this week, will afford the Institution an opportunity of reciprocating the courtesies shown to the members last year, and of cementing a friendship so happily begun on the other side of the Channel.

In some respects, our meeting this year cannot be said to be inaugurated under quite such rosy auspices as in 1897. We have to deplore the loss of two members through death since we met last year—one a very prominent member, and a Past-President of the Institution, whose place amongst us cannot easily be filled up. We are powerless to prevent these sad occurrences; but when they occur, let us brace ourselves to maintain the reputation of the Institution for energetic and useful work as the best antidote to the inroads of the Great Reaper. More especially let us look to the younger members of the Institution to keep alive the originality of our proceedings, and give them every possible encouragement to impart their views and describe their experiments. To the younger men will fall the work of improvement and progress in the future; and, while a ripe experience is not to be undervalued as a guiding and correcting influence, the new hands are those most fitted, and most free, to develop the new ideas, and bring them to a practical issue.

Last year we met fresh from the realization of a great increase in the annual consumption of gas, which induced

sanguine expectations of rapid augmentation in the extent and importance of our gas undertakings. This year, we come together in the knowledge that, temporarily, these expectations are not to be realized. The fickle climate under which we in Britain are placed, has ordained that an unusually mild winter should put a restraining hand on the demand for gas; and in some of the larger undertakings the consumption has remained more or less stationary in the past year.

The serious and prolonged strike in the engineering trades, which lasted from July, 1897, till February, 1898, was not without an important influence on the progress of the gas industry. It deprived us of many sources of gas consumption, and otherwise affected us prejudicially in delaying the execution of contracts for ironwork and machinery required for last winter's work. The strike directed afresh the attention of the public to the seriousness of the labour question; and it was felt more than ever that steps must eventually be taken to bring about a community of interests between employer and employed. In all branches of employment, there is still far too much of the old idea that the person employed is in some sort of sense a chattel of the employer; and, though the British workman has to a large extent succeeded in emancipating himself from this bondage, he is yet almost universally in the position of being eventually used up by the system under which he works, without having the chance of sharing in the prosperity which his labour has created, or reaping any after-benefit from his years of service, when his powers as a worker fail. So long as the worker has no direct interest in the prosperity of the undertaking he works for—be it a private enterprise or a public concern—it is not surprising if he seeks his own immediate benefit, even though it be at the cost of ruining the industry with which he is identified. Once let him, however, be placed in the position in which he can see that his own interests and those of the business are identical, and he will think for the future as well as for the present, and a common ground will be established. That such a condition of things may be brought about by a judicious application of the profit-sharing principle, has already been proved in more than one class of industrial enterprise.

A strike of workmen invariably gives increased force to the arguments in favour of the adoption of machinery for all mechanical purposes. It is not that there is any aim to ultimately reduce the number of workers, but that a way may be found to, in some degree, accord to them the remuneration and the comfort they desire, without at the same time handicapping the industry with an increased cost of production. Thus, in gas-works the adoption of machinery for handling the raw material and solid bye-products is becoming more and more universal. In small undertakings, the Committees and Boards of Directors are now found willing to spend large sums of money on means to effect this—in some cases, it may be, without due regard to the return that may be expected, but always with a view to diminish the multiplicity of hand labourers engaged in unintelligent operations, and increase the status and responsibility of the workmen.

As a necessary consequence of the fulfilment of these aims, the capital cost of installations of new carbonizing plant has increased, while the working expenses have diminished. There is nothing surprising about this, for, in the first place, whatever current expenditure is saved by transmuting the energy employed in mechanical operations from manual power into power exerted by machines, must in the process of conversion be capitalized; and, secondly, as the interest payable on capital becomes less and less, so it becomes more and more advantageous to capitalize the expenses. At the present day, the cost of equipping a large retort-house with modern regenerator settings, power machinery for stoking, and machinery for elevating and conveying the coal, and for removing the coke, amounts to about £100 per mouthpiece. This cost may be roughly divided as follows:—

Retort-house with stage floor	£35
Retort-settings and fittings, including chimneys	40
Stoking-machines and coal-elevators, &c.	15
Coke-conveying machinery	10
Total	£100

Inasmuch, however, as a greater duty is obtained from modern plant in gas production per mouthpiece per diem, the cost of construction has not been proportionately increased in relation to the producing capacity; and it may now be taken to be equal to about £12,000 per million cubic feet per diem. But modern retort-houses perform their work at much lower cost for labour than the old description of plant. What formerly cost 3s. per ton of coal carbonized, is now done by machinery for 1s. 9d. per ton. This means a saving of £1250 per annum for every million feet of daily productive capacity.

The lowest estimate I have seen for the cost of a ground-floor retort-house worked entirely by hand is £8000 per million per diem.* Taking this as the standard of cost of the earlier type of retort-house, the saving effected by the application of modern machinery yields a return of 30 per cent. per annum on the increased capital expenditure. Besides this saving in the cost of manufacture, we have gained the advantage that from 30 to 50 per cent. more gas than formerly can now be produced on the same ground area.

The modification of the carbonizing plant known as the inclined retort system has, during the past six years, gradually acquired importance, both in England and abroad. Accompanied in the first attempts by difficulties and disappointments, it has fought its way to a firmer position, and now bids fair to become more and more universally adopted. No doubt exaggerated claims have been made on its behalf; but it cannot, I think, any longer be denied that it possesses certain very definite advantages—more especially for works the magnitude of which is not sufficient for the full development of power stoking machinery. Even in competition with stoking machinery, it is my belief that the inclined system is destined to display a distinct advantage. It is, perhaps, not at first quite easy to see wherein this advantage lies. There is the same retort area, with the same results in distillation; the same expenditure of energy is necessary to bring the coal to the retorts, and remove the coke. Wherein, then, is a saving in labour to be effected? I have come to the conclusion that the source of further economy is to be found partly in the fact that the coal, once it is elevated and conveyed into position for charging into the retorts, does not again require to be moved otherwise than by gravitation, and that no power, other than the same force, is needed to bring the coke out of the retorts; and partly because (at least, if retorts 20 feet long are employed) an equal quantity of coal is charged in half the number of operations. It is evident that the cost of attendance ought to be less when the coal finds its way into, and the coke out of, the retorts by virtue of their own weight, instead of having to be lifted and conveyed by power into and out of the receptacles for distillation. The cost of wear and tear should also, under these circumstances, be reduced. That up to the present time no absolutely reliable proof has been forthcoming that inclined retorts possess this economical advantage over machine stoking, I regard as due to the fact that as yet no installations of inclined retorts have been worked on a sufficiently large scale, and under such propitious circumstances as have for some time past attended mechanical stoking.

The cost of constructing inclined retort-settings is certainly greater than that of horizontal settings. In fact, from my own experience, I should put it at 50 per cent. more for the settings themselves. But possibly some reduction may be expected in the cost of the accompanying machinery. Should it be found, however, as I fully anticipate, that a reduction of 6d. per ton in wages over and above the saving which can be effected by machine stoking is to be realized, this additional saving will amount to 20 per cent. on the increased capital expenditure. One thing is certain about inclined retort-settings. They must be very carefully constructed, and very substantially braced by strong ironwork. Any neglect of these precautions is simply courting failure.

No radical departure from the usual type of carbonizing plant has yet been introduced with success. Devices for the continuous carbonization of coal in small quantities, constantly fed into retorts, have hitherto met with insurmountable difficulties, both in respect of the maintenance in good working order of the apparatus, and in the quality, and the means of removal, of the coke. Carbonization in bulk has received some encouragement in the progressive types of coke-oven now in vogue—notably that known as the Semet-Solvay system, with internal heating flues. But

* See H. E. Jones, "Proceedings of Civil Engineers, 1875."

in this type of oven, the bulk of the material dealt with is to a great extent sacrificed to other considerations; and the actual result is a nearer approach to the masses of material we are ourselves accustomed to carbonize.

The cost of repairs on a modern gas-works of magnitude is enhanced by the multiplication of machinery effecting the various operations, but not to an extent that seriously affects the total working expenses. The following analysis of the expenditure under the head of wear and tear at a large works where the stoking is all performed by machinery may be of interest, as showing the proportion due to each of the different operations carried on. I will not tax your patience by reading over the items; but you will notice that stoking machinery costs slightly more than 2½d. per ton for maintenance.

Analysis of Cost of Wear and Tear per Ton of Coal Carbonized at the Rochdale Road Gas-Works, Manchester.

Coal delivery department, including railway lines, locomotives, capstans, stages, steam cranes, &c.	0·84d.
Retorts—repairs and renewals of retorts and furnaces	6·66
Retort-fittings, including furnace-fittings	2·40
Stoking machinery, including elevators and conveyors, and engines working same	2·58
Tools—retort-house shovels, barrows, &c.	0·75
Sundries, in retort-houses only	0·51
Boilers, including boiler fittings	1·09
Exhausters, including engines and pumps	1·66
Condensers, washers, and scrubbers	0·33
Purifiers, including lifting gear for covers and elevating machinery for oxide, &c.	1·05
Station meters, gasholders, and governors	1·15
Workshops, including tools and machines in same	0·62
General (not applicable to above headings)	1·34
Total	1s. 8·98d.

Before leaving the subject of modern carbonizing plant for coal-gas manufacture, allow me to contribute one additional proof, to the many which have been adduced, of the value of the regenerative system of heating retorts. Up to the year 1891, the retorts at the Rochdale Road station of the Manchester Gas-Works—numbering 1066 mouthpieces—were all heated by the old method of direct firing. The quantity of coke sold in the year ending March, 1891, amounted to 6·67 cwt. per ton of coal carbonized. The re-construction of the retort-settings was commenced in that year, by the erection of a bench having producers, but no regenerating flues. The result, so far as saving in fuel was concerned, was practically *nil*. Subsequently, regenerators were added to the same settings, and further reconstructions were undertaken in which the principle of regeneration was fully applied. Last year three-fourths of the retorts in use at the works were heated on this system; and the coke sold had risen to 8·78 cwt. per ton of coal—the increased sales in that year representing an additional quantity of 15,330 tons of coke, the revenue from which was, in round figures, £4000. At the present time, all the retorts are on the modern system; and the works are now turning out 9½ cwt. of coke for sale per ton of coal and cannel carbonized. This, it should be noticed, is with a consumption of 40 per cent. of cannel, much of which produces little coke, of inferior quality.

The manufacture of carburetted water gas is a development which has already obtained considerable extension in the more important gas undertakings in Great Britain. As an instrument for the enrichment of coal gas, it has proved itself more economical than cannel under existing prices of oil. An analysis of the working expenses at Manchester, extending over four months of last winter's work, gave a net cost into the holders for 25-candle carburetted water gas of 1s. 1·65d. per 1000 cubic feet. It would certainly not have been possible to make 25-candle cannel gas at this price. When mixed with coal gas to the extent of 25 per cent. of the total, no inconvenience has been experienced from the greater density of the gas, nor has any complaint whatever arisen among consumers which could be traced to the admixture of water gas. It may be doubted whether the supply of carburetted water gas alone, or even as the greater proportion of the total, is desirable or prudent in this country. If, for this purpose, the water gas be made of lower illuminating power, the same advantage in cost price is not maintained. Water gas of 20-candle power costs only 2d. per 1000 feet less than that of 25-candle power; the difference being merely due to the lesser quantity of oil consumed. Though the opinion of experts has been freely given in favour of the harmlessness of supplying water gas, there are not wanting signs, even in America, of a tendency to restrict the supply of the unmixed gas. The inquiries made at Boston, in the United States, show that a feeling exists that the percentage of carbon monoxide in illuminating gas should be kept within certain limits.

The advantages of a water-gas plant in providing a means for the rapid augmentation of the gas production when required, has been frequently commented upon. It possesses also very important advantages in the lesser capital cost of the plant for a given make of gas, and in the comparatively small area of ground space on which plant of large productive capacity may be installed. As to the capital cost, it has been stated that carburetted water-gas plant costs only half, or less than half, what coal-gas plant costs. This I regard as incorrect. From the data afforded by our own experience in Manchester, I find the cost for all appliances up to, but exclusive of, the purifiers, to amount to two-thirds that of coal-gas plant. In round figures, the cost is £15,000 per million cubic feet per diem for coal gas, and £10,000 for water gas.

It has been assumed that the manufacture of carburetted water gas entails less expenditure on purifying plant than is involved in coal-gas making. This I think is wanting in confirmation. If the carbonic acid is abstracted, it is found necessary to have even more purifying area in proportion to the make of gas than is required for purifying coal gas from sulphuretted hydrogen alone.

Future designs for the extension on a large scale of carbonizing plant will probably take the form of a combination of the inclined retort system for coal gas, with carburetted water gas as the principal instrument of enrichment. Such a combination possesses many advantages. The capital expenditure can be kept within reasonable limits by the lesser cost of the water-gas plant; the productive capacity per unit of ground area will be at a maximum, and the working expenses at a minimum point. It must, however, not be forgotten that the cost of making carburetted water gas depends to a very large extent on the price of oil; the cost of the oil amounting, even at the present low prices, to over 70 per cent. of the total cost for gas of 25-candle power. A slight rise in the price of oil would therefore upset the balance of advantage; and it would not be wise to be dependent upon water gas to too great an extent.

During the past year, the attention of gas engineers in this country has been directed to two new possible methods of gas enrichment. One is that of returning a portion of the purified gas back into the crude, and still heated, gas; the theory being, it is assumed, that the addition of gas from which all condensable products have been abstracted, to the gas still charged with heavy hydrocarbon vapours, will enable the latter to retain certain hydrocarbons in suspension which otherwise would become liquefied. This process appears to have been carried on by Mr. Shadbolt, of Grantham, with success; and his results have recently received confirmation from an American source. The other method has arisen out of proposals emanating from Mr. Young, of Peebles, and Mr. Glover, of West Bromwich. These proposals, having for their primary object the elimination of naphthalene deposits, consist in the distillation of part of the coal or cannel at a low temperature, in order to produce a gas highly charged with illuminating vapours—which vapours the gas would not, if cooled and unmixed with other gas, be able to retain—and then mixing this gas with poorer gas produced at a high temperature. Experiments made by Mr. Samuel Glover, at St. Helens, go to prove that this method has for its result a decided increase in the illuminating power of the combined gases, as well as an important effect on the deposition of naphthalene.

Both these departures from the ordinary methods of procedure open up a new phase of the question of the distillation of coal and cannel, and point to the desirability of a better understanding of the particular treatment required by different classes of material. Nothing can be more certain than the fact that, in carbonizing a heterogeneous mixture of different kinds of coal and cannel under the same set of conditions, there results a loss all round of illuminating value. In large works carried on under such circumstances, the proportion of cannel required to maintain a certain illuminating power is much in excess of that which the value of the different materials, as revealed in experimental tests, shows to be really necessary.

In regard to the appliances for condensing, exhausting, washing, and purifying gas, no important advances can be said to have been recently made. Endeavours to utilize the ammonia in the gas as an agent for the partial removal of the carbonic acid and sulphuretted hydrogen, have met with a large measure of success in the hands of Mr. Holgate; but the complete purification of gas by liquid re-agents seems as far off as ever. Experiments made at one of the Manchester gas-works, with a view of reducing the sulphur compounds by washing the gas with ammonium sulphide, point to the necessity of saturating the causticized ammoniacal liquor with sulphur from some external sources, in order to produce a re-agent sufficiently powerful, and in large enough quantity, to effect any important result.

Exhausting plant remains the same in character as heretofore. Having regard to the importance of securing a permanent relationship between the volume and speed of the gas passing through the purifiers and the area of the latter, it has often surprised me that in large works the exhausters are not so arranged that each separate stream of gas is driven by an independent exhauster, or set of exhausters, through independent washers, into separate sets of purifiers, instead of the division of the gas into two or more streams being made after the exhausting and washing apparatus has been passed. Such a disposition of the plant would, it appears to me, ensure more complete control over the action and effect of the purifiers. It is possible that some of our London members have carried out this idea unknown to me; but I have not seen a works where, to my knowledge, it is in practice.

Much the same must be said of the purifying plant as of the foregoing; it remains essentially what it has been for the last twenty years. Certain ingenious attempts have recently been made in America to obviate the necessity of opening purifiers when a change of material is required, and to effect this change by the successive removal and replacement of the material by mechanical means while still enclosed in the purifying vessel. Nor are there wanting proposals in this country for the construction of purifying machines in which the gas may be treated with the usual purifying agents on a continuous and automatic principle. To what extent the appliances devised for these purposes will eventually commend themselves, remains to be determined. However crude at the present moment, they may prove to be the germs of some very practical system to be developed in the future.

While the cost of carbonizing plant has tended to increase, that for the storage of gas has diminished. Large gasholders are now the rule; and active spirits are still busy perfecting methods for safely dispensing with the guide-framing so long deemed to be necessary for the stability of this bulky apparatus. It must ever remain a matter of opinion whether the saving to be thereby effected in first cost is worth running any risk for; and it has yet to be proved—at any rate in the case of very large gasholders—that absolutely no risk is incurred by dispensing altogether with the guide-framing. The concentration of storage capacity in one, or at most two, large holders entails no anxiety in our days; and much advantage is found to be derived therefrom in the simplification of the connections, and generally in the working details, as well as in the reduced capital expenditure per million cubic feet capacity.

Of the distributory plant of gas undertakings, we hear very much less than its importance demands. The mains and services, being placed out of sight, do not attract the same attention on the part of Directors and Committeemen as do the parts of a gas-works. Nevertheless, the capital invested therein is very considerable; and the well-being of an undertaking is much influenced by the adequacy or otherwise of the provision made for delivering the gas to the consumers. In large cities, the difficulty of laying trunk-mains in the principal thoroughfares becomes more and more serious as these streets become the receptacles for electric cables, hydraulic pressure pipes, and other mediums of the supply of public conveniences. I am afraid that, for the most part, the system of gas-mains in our large provincial towns remains very much what it was in the early days of gas lighting, notwithstanding the immense extension which has taken place in the area of supply and in the volume of gas to be delivered. The number of leading mains proceeding out of the works has been multiplied; but the same principle of distribution has been maintained—viz., that of initial pressures of comparatively low degree, commencing at the works, and diminishing as the mains pass through the district and the gas is drawn off for consumption.

That this is, under existing conditions, an inadequate and wasteful system, goes without saying. Inadequate, because it cannot accomplish the desired effect of maintaining a uniform pressure throughout the district; and wasteful, because it means the sinking of an unnecessary amount of capital in a multiplicity of large leading mains. Electricians soon discovered that low-pressure supply entails too heavy a capital expenditure; and, although gas-mains are less costly than electric mains, there is no reason why we should adhere to a system the defects of which are so apparent, when the same remedy is just as easy to our hands as to those engaged in electric lighting. The fear of high pressure in conducting mains is a "bogie" the dangers of which are greatly exaggerated. We know from experience that mains of considerable size, if well laid in the first instance, do not give rise to leakage of any importance. Why, then, should we not have high-pressure trunk-mains delivering gas into the distributing mains through governors, acting as transformers, situated in convenient positions in the district, in or near the centres of consumption? By adopting such a system, we should dispense with the constant duplication or enlargement of leading mains; and the problem of increasing the delivery of gas would resolve itself into putting additional governors in fresh positions, and connecting them to the district mains.

Too little is known about the proper relationship of the mains to the consumption. Although there are well-defined formulæ for the calculation of the capacity of main pipes as regards the delivery of gas, yet the size and number of main pipes used for the supply of a definite hourly quantity is subject to an almost infinite variety; and the divergencies between the main piping in one town and another are most unaccountable. There are, of course, differences in the conditions of supply in different towns; but it is difficult to believe that these differences are so great as to account for such divergencies in the length of piping, and the consumption of gas, as are to be found among the returns of gas undertakings.

Then there is the question of unaccounted-for gas. Out of a total annual make of gas in the United Kingdom amounting to 127,000 million cubic feet, 10,000 millions are unaccounted for; representing a million tons of coal annually apparently wasted so far as any return for it is concerned. This is equal to 8 per cent. of the gas made. Although part of this is, no doubt, due to shrinkage through reduction of temperature, there still remains a serious deficiency which cannot thus be accounted for. There does not appear to be much difference between Gas Companies and Municipal Undertakings in respect of unaccounted-for gas. There are, however, many undertakings of both kinds which fail to come up to the usually accepted standards in regard to sales of gas per ton of coal. Among the Companies, 52 per cent. of the total number included in the last Parliamentary Returns sell under 9000 cubic feet to the ton, and 19 per cent. sell under 8000 cubic feet per ton. Of Local Authorities, 54 per cent. sell less than 9000, and 16 per cent. less than 8000 cubic feet per ton. Amongst the small undertakings, both of Companies and Local Authorities, are to be found the most extraordinary sinners in this respect; but there are not wanting undertakings of magnitude whose returns might be improved with marked advantage to themselves. There is surely proof here that the distributory plant does not receive that attention which it deserves. Whether the discrepancy between the gas made and the gas sold is to be charged to leaky mains, decayed service-pipes, or incorrect meters, there are defects somewhere which might and ought to be remedied.

Whilst upon the subject of the Returns as to Gas Undertakings, I wish to call your attention to the fact that the number of authorized undertakings owned by Companies has in ten years increased by 14 per cent., and those in the hands of Local Authorities have increased 28 per cent. But the capital employed by the Companies has increased 35 per cent.; whilst that of gas-works owned by Local Authorities has increased only 27 per cent. In 1886, the capital employed by Gas Companies amounted to £6 6s. 9d. per ton of coal carbonized; in 1896, it amounted to £6 9s. 2d. per ton—an increase of 2s. 5d.

The capital employed by Local Authorities amounted in 1886 to £5 12s. 1d. per ton of coal; in 1896, it stood at £4 8s. 10d. per ton—a reduction of £1 3s. 3d. per ton having taken place. These figures reveal the great advantage Local Authorities possess in the redemption of their capital by means of a sinking fund—an advantage which it has been suggested should be given to Gas Companies also. Surely, however, apart from this, it might be expected that the Companies would, in the course of a decade, show some reduction in capital account per ton of coal carbonized, due to their growth of business; for, as the magnitude of the operations increases, the cost of the additional plant diminishes, and the dead-weight of capital due to preliminary expenses becomes spread over a larger total. I make these remarks in the full knowledge that many Companies do keep this desired end in view, and follow it successfully.

There is another influence at work, the effect of which is all in favour of an ultimate reduction in the proportionate capital employed, and that is the gradual levelling-up of the day consumption, and the diminution of the difference between the summer and winter consumption caused by the employment of gas for other than lighting purposes. The rapidly extended use of cooking-stoves, encouraged by the hire system and by the slot meter, with its accompanying free boiling-stove, is continually increasing the proportionate consumption of gas during daylight hours. The use of gas as a motive power further assists in accomplishing this result. During ten years the day consumption in Manchester has risen from 20 to nearly 30 per cent. of the total; and I do not doubt that there are many undertakings in which a more marked result has followed the endeavours made to develop the day consumption. As for the winter consumption as compared with that of the summer months, we find in Manchester that the rate of increase is greater during the latter than during the former, and that the extension of electric lighting has tended to keep down an unusually large demand on foggy days in winter, while not perceptibly affecting the annual consumption as a whole.

In the matter of utilizing the energy in coal gas, we are yet only in the elementary stage; but great changes are impending. Hitherto a mere fraction of this energy has been converted into light; but the incandescent gas-burner and the Welsbach mantle have opened the way for the conversion of a much larger proportion of the store of heat-energy contained in gas into illuminating effect. The improved burner now being introduced by the Welsbach Company will, it is believed, greatly enhance the value of this method of lighting. The importance of these developments can hardly be over-estimated. While the utilization of the energy of the electric current as applied for producing light has apparently little margin left for improvement, there remains an almost boundless surplus energy in gas. Its economical conversion into light must be our special study in the immediate future. When gas lighting becomes independent of the direct illuminating power of the gas, we shall be able to supply a gas which, while satisfying all requirements for illumination, will be cheap enough, and yet possess sufficient energy for all the various purposes, industrial and domestic, for which gas is so eminently convenient. Under such improved conditions, public lighting by gas will continue to be the cheapest and most effective system; and as the consumption of gas per unit of light evolved diminishes, and the consumption for other purposes increases, the present strain on the resources of the gas-works in our large towns, due to fogs added to the normal winter consumption, will be relieved, and a more regular rate of consumption be attained.

One source of the revenue of gas undertakings has unfortunately been of late a diminishing quantity. I refer to the sale of our residual products. Tar and ammonia do not at present, and probably never will again, command the prices they once did. So far as tar is concerned, gas tar does not now contain so large a proportion of the more volatile hydrocarbons as formerly; but seeing that the market value of benzol has become so reduced, it does not appear that the lesser quantity of this constituent can seriously affect the returns realized for tar. In the manufacture of sulphate of ammonia, the margin of profit has been so low during the last few years, that only with plant of the most economical character, in which mechanical appliances have been substituted for hand labour throughout, could gas undertakings show any advantage in working up their ammoniacal liquor. There are now signs of a permanent improvement in the price obtainable for this product; and in the case of those undertakings which still sell their tar and liquor, the adoption of a sliding-scale of prices has at least ensured them a fair share of the profits to be realized. The endeavours which have been made to add to the returns from the bye-products of gas manufacture by the abstraction of the cyanogen in the gas have not met with all the success anticipated, owing to the fluctuation and uncertainty in the value of cyanides. Coke still remains a valuable source of revenue; and the increased yield of coke disposable for sale has done much to counteract the loss of income from the other residuals. Much may be done to create and maintain a good demand for coke at fair prices by studying the requirements of the district in which it is desired to sell it, and providing the necessary machinery for cleaning, breaking, and separating the coke and breeze into such sizes as are suitable for the purposes for which the former is required.

Gentlemen, I think you will agree with me that the foregoing review of the present position of the gas-manufacturing industry, imperfect though it is in many respects, suffices to show that, while changes do, and inevitably must, occur in the conditions under which we have to carry on the business, there is nothing in these changes to alarm us, nor are they likely to be so sudden as to upset our calculations or revolutionize our methods. Nevertheless it behoves us to be on the alert to appropriate all such modifications as the change of circumstances may give rise to; and, if we cannot ourselves become the initiators of them, to grasp and appreciate their value, and be the first to utilize them to our own advantage. I rejoice to feel that to this Institution, and to kindred associations in this and other countries, assisted by the technical press, belongs the credit of keeping alive the interest in, and bringing about the adoption of, all such improvements in the working and administration of the numerous undertakings identified with the supply of gas—an industry in which, in Great Britain alone, more than 70 millions sterling are invested; and that the employment of this immense capital continues, under the technical management which we here to-day largely represent, to be uniformly productive of good financial results.

The Transactions of the Institution of Gas Engineers for 1897.—We have received the volume of Transactions of the above-named Institution for the past year, containing the papers read at the spring meeting held in London, with the discussions thereon, and an account of the visits paid on that occasion and in the autumn, when the members went to Amsterdam and Brussels. In an appendix are given the "First Report of the Committee on the Proposed Standard of Light and Temperature of Gas Measurement," which was published in the "JOURNAL" early in the year; and a "Description of Exhausting and Pumping Plant" at the Bankside works of the South Metropolitan Gas Company, communicated by Mr. C. C. Carpenter. These matters are followed by abstracts of papers bearing on gas manufacture which have appeared in various chemical journals. The volume has been produced under the editorship of Mr. T. Cole.

The North of England Gas Association and Workmen's Compensation Insurance.—The publication in the "JOURNAL" last week of the letter on the subject of workmen's compensation insurance addressed by Mr. J. H. Penney to the members of the North of England Association of Gas Managers has brought inquiries from several gas companies in the South of England as to whether it will be possible for them to join in the scheme. Mr. Penney thinks there could be no objection to this, as it would swell the aggregate amount, and so reduce the premium. He has obtained from a first-class office the following amended quotation: Wages not exceeding £100,000, 10s. per cent.; do. £150,000, 9s. 6d. per cent.; do. £200,000, 9s. per cent.; do. £300,000, 8s. 6d. per cent.; and exceeding this amount, 8s. per cent. A cover note will be issued to any Gas Company until the combined amount of wages to be insured is ascertained.

Calcium Carbide from Basic Slag.—A recent number of the "Zeitschrift für Elektrochemie" contained an article in which reference was made to a process for the extraction of phosphorus and calcium carbide from basic slag. Tricalcium phosphate is mixed with an excess of powdered carbon, and heated in an electric furnace, whereby calcium carbide, phosphorus, and carbonic oxide are formed. The phosphorus passes over into a condenser, and is recovered; the yield being claimed to be 80 per cent. of the total present in the mixture. The writer described a series of experiments made by himself with a view of converting the phosphates of these slags into phosphides—the latter to serve as a deoxidizing material for overblown iron. The results, however, proved negative; the lime in the slag giving off its phosphorus, and changing into calcium carbide.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1403.)

Business was decidedly slack last week on the Stock Exchange; and there is already a sort of holiday feeling creeping into the atmosphere of that establishment. The long awaited fine weather had something to do with this. It also had a cheering effect, and helped to bring about a generally firm tendency, despite the reduced activity. Thus, as a result, prices in almost every line show a moderate advance on opening figures. The Money Market continues extremely easy; supplies being overabundant, and commanding only very light rates. The Bank of England rate was not lowered (it is not usual to reduce it three Thursdays running); but it is quite possible a further reduction will not be long deferred. Business in the Gas Market was, on the whole, a little more brisk than in the preceding week; but it was somewhat fitful and capricious—some days promising a burst of activity, and then dying away to next to nothing. However, there was a bright tendency throughout the week, and never better than at the close, with the result that several important issues have made moderate advances in value. Gaslight "A" was strong, and profited by its fresh victory in the House of Commons on Thursday over those rough-and-ready reformers who with cheery *insouciance* are prepared at a moment's notice to blow up the parliamentary foundations upon which the gas industry of the country has rested for nearly a quarter-of-a-century. The secured issues, too, were in good request; and several of them advanced their quotations. South Metropolitan was firm, and pushed its price up a couple of points; but not very much stock changed hands. The debenture also recovered. Nothing at all was done in Commercials. The Suburban and Provincial Companies showed a nearly blank list; the only movement was a slight reduction in Brentford debentures. The Continental undertakings were extremely inactive. But they held firm; and Continental Union advanced on *ex div.* quotation. Movements among the rest were slight and unimportant. In Water, business was very quiet on the whole. New River, however, was in demand and advanced. Southwark also improved; but Chelsea receded.

The daily operations were: On the opening on Monday, Gas securities were very steady, and prices ruled good through the day. South Metropolitan ordinary and debenture rose 1 each. On Tuesday there was a lull in business; but prices showed no sign of weakening. In Water, New River gained 2; Chelsea fell 2½. Business still continued very moderate on Wednesday; but the firmness in value was unabated. Gaslight "K" advanced 2. Thursday was almost a repetition of the preceding day, without any further changes being made in quotations. Friday was the busiest day of the week, especially for Gaslight "A," which advanced 1. South Metropolitan also improved 1. In Water, Chelsea preference and Southwark ordinary moved up 2 each. Saturday was bright, though not active. Gaslight "C," "D," and "E," and ditto "K" rose 2 each; and Buenos Ayres, ¼. In Water, Southwark ordinary advanced 3 more.

ELECTRIC LIGHTING MEMORANDA.

The Competition of Vestries with Companies—The Cases of Bermondsey and Marylebone—The Question of Policy.

It is reported that the Board of Trade have decided to grant Electric Lighting Orders to the Vestries of Marylebone and Bermondsey, notwithstanding the existence in these parishes of statutory electricity supply undertakings. This is a serious stretching of the principle of limited and conditional competition in electricity supply recognized by the Electric Lighting Acts; and there is evidence to show that the Department regard their own action in this light. It has always been understood that the Board of Trade would grant Provisional Orders to two undertakers of electricity supply from one and the same area, provided that the systems proposed to be adopted were different. This principle has been confirmed in more than one instance during the last year or two, when Metropolitan electric lighting companies working different systems have been encouraged to advance into one another's territory. Hitherto, however, such competition has been between companies only. There has been another understanding also—that, where a local authority had a Provisional Order, competition by a company, irrespective of the question of systems, would not be allowed. Now it seems that the only other case in which competition in statutory electricity supply is conceivable—that of a local authority with a company already in possession of the district—has been dealt with by the Board of Trade in a manner which amounts to favouring the local authority at the expense of private enterprise. It is worth inquiring how this has come to pass. The importance of the Board's decision need not be emphasized.

Each case, to begin with, has been treated on its own merits. Bermondsey applied for an Order, alleging that, though two Electric Lighting Companies had mains running through the parish, these were only trunk mains for the supply of other districts; the Companies not seeing fit to attempt to do a local trade. This was proved to the Board of Trade; but nevertheless the Companies opposed the application made by the Vestry. The Department took serious note of the opposition; but overruled it so far as to grant the Order. In communicating the decision of the Board to the Vestry, Sir Courtenay Boyle stated that the Order had only been granted with a view to giving Parliament an opportunity of expressing an opinion on its policy. The opportunity will be made use of; Mr. Cripps having given notice of motion that the confirmatory Bill be read a second time "that day six months," when it comes on in due course. It will be for the Vestry to take steps for the defence of their Order; and this they have decided to do. In the case of Marylebone, the Vestry propose to compete with the Metropolitan Electric Supply Company, who are actually doing private business in the parish, and are carrying out contracts with the Vestry for public lighting in certain parts. The position created by the decision of the Board of Trade to grant the Vestry an Order in these circumstances is, therefore, unique; and the private electric lighting interest is not going to let the Order be confirmed without a struggle. The Local Authority already have the right of acquiring the local electric light undertaking at the expiration of its own Order; and if public money is meanwhile to be employed in carrying on a competing undertaking, the lot of the Company can hardly be a happy one. If such a proceeding is permitted by Parliament, it can only be by establishing some new principle of expediency, wholly differing from anything that has been recognized in the past. The subject was mentioned at the recent general meeting of the Metropolitan Company; the Chairman observing that the Board had every reason to hope they would be successful in defeating the proposal of the Vestry, which had had the temporary effect of depreciating the value of all electric light companies' shares. On the other side, it appears that the representatives of the Vestry are not too sanguine of getting their Order through Parliament. The case for the Vestry and the Board of Trade is not devoid of cogency. Two Companies, besides the Vestry, sought Orders which would have enabled them to compete with the Metropolitan Company; and the Vestry thought that if there was to be competition in the business they might as well take a hand in it as anybody else. The Board of Trade appear to have held that there was sufficient reason in this view to submit to the wisdom of Parliament; and most outsiders will agree in this opinon, so far as it goes.

When it comes to the question of how a local authority and a private company are going to carry on the same business side by side, the matter enters upon another phase. Competition between two companies, one supplying electricity by the alternating system, and the other trusting its money to the continuous current system, is one thing. Nobody has yet been able to declare definitely which is the better of these systems, in a general way; and the Board of Trade are justified in letting the public take their choice of them, wherever the enterprise of undertakers places both on offer. It is not without significance that such an alternative does not exist out of London—and the very heart of London at that. But to let the Marylebone Vestry compete by the aid of public money, sunk in an electricity supply undertaking on the continuous current system, with a private Company actually paying parochial rates out of money earned by working an alternating system, is not competition between systems. It is the conflict of private enterprise, admitted upon a statutory guarantee, with the use of public funds for a purely commercial object; and we cannot conceive that Parliament will admit that the public interest is likely to be served by any such proceeding. This is a question that does not concern Marylebone alone, nor even electricity supply exclusively; and it can only be rightly answered in one sense.

PRECURSORS OF THE NEW WELSBACH BURNER.

The descriptions of the new Welsbach gas-burner given in the "Journal" for May 3 and 10 (pp. 1009, 1062) have attracted the notice of several of our Continental contemporaries. In the course of an article mainly based on our descriptions of the burner, the "Journal für Gasbeleuchtung" makes the following suggestive remark:

"In the new burner, *just as in those constructed by Bandsept and others*, the fundamental idea is the production in the burner itself of a 'self-burning' mixture of gas and air—that is to say, a mixture which can burn completely without accession of more air from without." The italics are ours; and the italicized words suggest that the fundamental idea of the new burner has been embodied in other burners of earlier date. If this be true, it becomes pertinent to inquire what are the extent and nature of the divergence of the new Welsbach burner from the Bandsept and similar burners which preceded it by many months. The new burner, as our readers are aware, is an invention of M. Ottmar Kern, of Paris; and the first patent referring to it dates from January of last year. Several of the patents of M. Bandsept date from 1894 and 1895. In what respects do the inventions covered by these patents differ from the invention of M. Kern?

The Bandsept burners, as described in the patent specifications and in a pamphlet that was written by the inventor in 1894-5, comprise two essential parts—viz., an injector and a

disintegrator. The injector consists of a fine conical jet, through which the gas issues at considerable speed, owing to the very gradual tapering of the gas-passage leading to it. The gas issuing from the jet draws along with it, through a hollow frustum of a cone, air which is admitted at or near the base of the cone. Above this frustum is a chamber, which, in some cases, has the form of a frustum of an inverted cone; and in this chamber the gas and air issuing from the narrow top of the first frustum (or tuyere) expand. In place of one tuyere, there may be two or more superposed on one another; and there may be more than one series of air-inlets. The expanded mixture of gas and air then passes through the disintegrating passages and orifices which M. Bandsept terms the "atomizer." M. Kern's burner, as quite recently described in the pages of the "JOURNAL" (p. 1062), has the gas-jet or nozzle; above it a frustum of a cone, which is known as the mixing cone; above that is a frustum of an inverted cone, which is known as the suction cone; and the whole is surmounted by a hollow perforated cylinder closed at the top, through the perforations in which the gas issues. Around this perforated cylinder is a hollow cylinder, to which is attached a cap and the burner nozzle. The chamber formed by the walls of this cylinder is known as the mixing chamber; and the perforations in the hollow cylinder serve as disintegrating passages. Thus far there appears to be but little difference between the Kern and some forms of the Bandsept burner. The effect is nearly the same with both—a self-burning mixture of gas and air is obtained at the mouth of the burner, through the action of the injector (comprising a tuyere or suction cone and an expansion chamber or mixing cone) and the atomizer or mixing chamber. That M. Bandsept aimed at producing, and did produce, a self-burning mixture of gas and air is shown by a statement he made in 1894, to the effect that he obtained combustion under water without any auxiliary supply of air.

The production of the self-burning mixture of gas and air by means of two frusta of cones placed above a gas-jet with their narrow ends abutting, and a disintegrating device, has therefore been no novelty since 1894, at the latest. What advantages then does the Kern burner possess for the production of such a mixture? Evidently the dimensions of the frusta have been closely studied by M. Kern, for he allows very little latitude in this respect. The best results, he says, are obtained when the angle of divergence of the suction cone is between 5° and 7°; and again "the suction cone should be about twice as long as the mixing cone." Moreover, he concludes that it is not sufficient that the bunsen tube be shaped so that its bore defines two truncated cones, joined at their small ends; since this general construction would be altogether useless for the purposes of the invention, unless the proportion of dimensions (as above indicated) is carefully observed. Now the Bandsept burner is not "altogether useless for the purposes" of Kern's invention; and it therefore would seem that M. Bandsept hit hap-hazard on dimensions which M. Kern has since been at much labour to ascertain and define, or else that M. Kern has placed an altogether undue stress on the utility of burner tubes made in accordance with his dimensions. We are not aware that M. Bandsept ever defined the dimensions of his burners with the same scrupulous care that M. Kern has used; and if the dimensions stated by the latter really give superior results, he appears to have achieved one distinct advance.

Another point in M. Kern's specification is worthy of the closest attention. It is his careful study of the heating capacities of different portions of the self-burning flame with different adjustments of the throttle rings. He arrives at the discovery of what he terms the "hyperincandescent zone;" and thereupon he endeavours to construct the mouth of his burner, and to suspend the mantle, so that the surface of a considerable portion of the mantle lies within the hyperincandescent zone of the flame. The result is that the filaments in that portion of the mantle are raised to intense incandescence. M. Bandsept, on the other hand, appears to have been impressed especially with the homogeneity of the flame from his self-burning mixture. Here there appears to have existed a difference in the views of the two inventors as to the nature or structure of the flame which would give the highest degree of incandescence. After pursuing together the same train of thought nearly to the culminating points of their inventions, they suddenly took divergent views; and it would be rash at the present juncture to say that the divergence gives the invention of the one an undeniable superiority over that of the other.

Unquestionably M. Kern's burner affords unsurpassed results; but almost equally good results have since been claimed by M. Bandsept. In many essential points, the burners are similar; and it remains to be seen if the points of dissimilarity are of consequence. If they are, the honour of producing the best incandescent gas-burner will be chiefly M. Kern's; if they are not, M. Bandsept must undoubtedly be accorded the major share of the honour.

Another Use for Street-Lamps.—In the "JOURNAL" for the 10th ult., we recorded the registration of a Company for working a patent for a combined lamp-post and hydrant, with the view of affording better protection of life and property against fire. The Battersea Vestry have granted permission for the erection of an experimental post; so that the practical utility of the patent will shortly be demonstrated,

THE DISCOVERY OF NATURAL GAS IN SUSSEX.

NOT a little interest was aroused towards the close of last year by the appearance in "Nature" of a letter by Mr. C. Dawson, F.G.S., F.S.A., recording the accidental discovery of a large quantity of natural gas in the parish of Waldron, Sussex. The matter was briefly alluded to in the "JOURNAL" at the time.

The discovery, it may be remembered, was made under the following circumstances: During the progress of some well-boring operations which Messrs. Le Grand and Sutcliff were carrying on at the Heathfield Hotel about three years ago, an oily odour was noticed at a depth of 228 feet, and the presence of gas became evident. As there happened to be water in the tube of the well, the gas, as it rose, caused an ebullition which might be described as boiling with heat. The foreman in charge of the work piped off the gas to a distance of several feet, and there consumed it; the flame rising to the height of a man. The boring was then carried down about 20 feet farther; but as gas continued to come instead of water, the undertaking was abandoned, and the boring closed. Nothing more was thought of the matter until the same firm were engaged upon similar work in August, 1896, for the London and Brighton Railway Company, about 100 yards distant to the south, and some 43 feet below the level of the top of the former boring. The sinking was commenced in the lower strata of the Ashdown sand (the Hastings beds), and was continued to a depth of 377 feet—below the Purbeck beds. In this boring, also, gas was noticed, but at a greater relative depth; and its quantity increased as the sinking proceeded to 312 feet, when the rush of gas became very great. On a light being applied to the top of the lining-tube of the bore, a flame immediately sprang up to a height of 15 or 16 feet, and burned with great fury until it was extinguished by the application of damp cloths. A certain quantity of water was discovered, but not sufficient for the Railway Company's purpose; and the boring was abandoned—nearly all the tubes being withdrawn. Notwithstanding the partial blocks thus occurring through the falling in of the sides of the borehole and the pressure of a great column of accumulated water, the gas continued to flow from the tube in considerable bulk. It has been calculated that the pressure at its source at the bottom of the tube cannot be less than 135 lbs. per square inch; the pressure at the surface being 15 lbs. per square inch. An iron cap was fixed upon the top of the tube, with a vent so as to allow the escape of gas to take place continuously. When lighted, the jet blazed out into a flame about the same size and colour as one of the naphtha "flares," about 12 inches long, commonly used at markets and fairs. At the date of Mr. Dawson's communication, the cap and vent had been in position about fifteen months; and the gas showed no signs of diminution. This is very much the condition of things at the present time.

There is the gas; and the question arises: What is its origin? Mr. Dawson says we shall look in vain to the rock details of the boring for information on this point. Certain small beds of lignite occurred in the section; but he thinks the enormous supply and pressure of the gas cannot be accounted for on any theory that it emanates from these beds. The greater probability seems to be that it is derived from either the Purbeck beds or the Kimmeridge clays, by percolation through the comparatively porous strata above. In connection with the famous Sub-Wealden boring at Netherfield, in 1875, Mr. Henry Willett, F.G.S., mentions the occurrence of inflammable gas in the Purbeck strata, and at a short distance above certain strata in the Kimmeridge clays recorded to be very rich in petroleum. This is the first account of the class of gas which has now again been met with in East Sussex. The Purbeck beds are known to contain a certain amount of petroleum and bituminous matter—one bed being particularly rich; but far richer beds lie below, in the clays immediately above which Mr. Willett discovered the gas. This is a matter, however, as also the subsidiary one of the association of petroleum, which Mr. Dawson says can only be satisfactorily determined by means of a deeper boring. Possibly the copious supply of gas at Waldron indicates the presence of a larger quantity of its usual associate—petroleum—than has been before recorded in the underlying beds. This is an interesting feature of the problem; the experience in America (the land of natural gas) being that the gas is the forerunner of petroleum. The same may be the case at Heathfield.

The geological formation of the part of the county of Sussex in which Waldron lies appears to be favourable to the production of natural gas. It is recorded by Mr. Henry Nicholls, of Deal, an owner of property at Hawkhurst, that between the years 1836 and 1840, a well was sunk at the latter place to a depth of 98 feet. After passing through a certain amount of heavy sand, a blue clay of a very oily, flaky nature was met with, mixed with yellow and red streaky clay. This continued to the bottom of the well. An artesian boring was then commenced—the men working by candle light. Having bored some 60 feet more—or 148 feet from the surface, the auger struck a rock and fell into a cavity. An inflammable gas immediately ascended, which became ignited by the lights of the workmen; and two were immediately killed. An eye witness says the gas burned slowly up the well till it reached nearly to the top, when, coming in contact with the outer air, it burst out into a sheet of flame, some 20 feet high. It then slowly burnt itself out. The

water in the well was useless; and Mr. Nicholls had the well filled up. Mr. Dawson says this seems to have been an instance of an inflammable gas occurring in association with strata containing a rock oil—the gas itself accumulating in a cavity, or what is called by the Americans a "pocket." It serves to show that it is unwise for well sinkers to use artificial lights at the bottom of a well when boring for water, except perhaps in properly constructed miners' lamps. He records another somewhat interesting occurrence near Ticehurst Road, Sussex, about six or seven years ago. There is a certain low-lying field, called the Bogs Brook, close to the Ticehurst Road Station of the South-Eastern Railway. It is a marshy spot, and sometimes large bubbles of inflammable gas continuously rise and break on the surface of the pools. One Sunday in a particularly dry summer, when the bog was dried up, some boys were about to enjoy a clandestine smoke when a match thrown down suddenly ignited something believed to be inflammable gas. The boys ran away, and the whole field was soon a mass of flame. The peat of the bog also took fire, and burned for a week or more, when some heavy rains soaked the land and put out the fire. These subjects, though interesting, have perhaps only a relative bearing upon the more important question of the occurrence of inflammable gas coming from artesian borings having a continuous flow during months and years, and existing under a high degree of pressure.

Reverting to the origin of the gas, beds of lignite, and a variety resembling cannel coal, about 2 feet thick, have been met with near the surface of the ground at Waldron; and several bands were pierced by the boring where the gas was found. A portion of the lignite in one of the beds at a depth of 347 feet, at the junction between the Fairlight clays and the Purbeck beds, has been analyzed for the Railway Company by Dr. J. T. Hewitt, Professor of Chemistry at the East London Technical College, and its constituents reported to be: Moisture, 4·90; volatile matter, 15·55; fixed carbon, 1·74; ash, 77·81. Mr. Dawson does not think this throws much light upon the subject. Dr. Hewitt has also analyzed the gas, which he says is composed of three constituents only—marsh gas, 91·90; hydrogen, 7·20; nitrogen, 0·90. Oxygen, carbon dioxide, carbon monoxide, the olefines, and hydrocarbon vapours were absent. Mr. Dawson points out, in reference to this analysis, that marsh gas and hydrogen, though inflammable, burn only with a blue non-luminous, or comparatively non-luminous, flame. Nitrogen is not an inflammable gas. It is clear, therefore, that there is nothing in the analysis which can account for the illuminating power of the natural gas at Heathfield, which, as already remarked, gives a yellow flame. The gas when consumed by means of an ordinary batswing or flat-flame burner is so luminous that any ordinary and casual observer would not notice the difference between it and ordinary household gas, though a difference does actually exist. It must consequently be supposed that either some luminous property in the gas did not present itself in the sample taken by Dr. Hewitt, or that some variation has occurred in the constituents of the gas—a feature which appears to be not uncommon in the natural gas of the United States. Mr. Dawson and others have seen the gas burning many times and at different periods; but this non-luminous phase has not, he says, presented itself to him or to anyone whom he has met. A sample of the gas was submitted for analysis to Mr. S. A. Woodward, B.Sc., the Public Analyst for Sussex, and Professor of Chemistry at the Agricultural College, Uckfield, who devoted much time and attention to the matter in order to secure accurate determinations. He set up his laboratory on the spot; an unlimited quantity of gas was supplied to him from the bore-hole; and he carefully checked his results, which were as follows: Oxygen, 18·0; higher hydrocarbons, 5·5; carbonic oxide, 4·0; marsh gas and ethane, 72·5. He did not find any impurities; but there were indications that it was a petroleum derivative.

The only remaining question is as to the utility of the gas. Having an illuminating power of only 9½ candles, its value *per se* for light-giving purposes is not very great. But in these days of incandescent lighting and the use of gaseous fuel it is rather the heating property of a gas that is of value. This the Heathfield gas possesses in a high degree; and therefore it will be in combination with an atmospheric burner and a mantle that it will (if ever) be brought to do useful work in the field of lighting. That it is fully capable of doing such work was demonstrated last Wednesday night, when Mr. Dawson and Dr. Hewitt laid before the Royal Geographical Society, with the necessary detail suited to their audience, the results of their investigations, of which an outline has been given in the present article. On that occasion, there was an exhibition of the gas by the Denayrouze Lighting Syndicate, of Victoria Street, Westminster. Along the table in the centre of the room were ranged a series of burners, beginning with one using the gas alone, and ending with a cluster of three incandescent burners, with two single ones between them. The first of these (a Bandsept CX), with a consumption of 2½ cubic feet of gas, at 25-10ths pressure, gave the light of 72 candles; the second, with a consumption of 4½ cubic feet, gave 125 candles, with the old form of Bandsept burner. The group, composed of modified Bandsept burners, yielded 372 candles for 13½ cubic feet of gas. This group, the illuminating power of which was slightly raised by an increase of pressure, produced an exceedingly brilliant light, which more than sufficed for the room when the electric lights were switched off. Mr. C. E. Masterman, General Manager of the Syndicate, was in attendance, and, at the request of the Chairman, furnished particulars as to the burners and mantles. The event was unique, as it was certainly the first occasion on which a meeting-room in London had been illuminated by natural gas.

It would seem that uses may be found for this newly-discovered gas, provided that its continuous supply can be depended upon, and that it can be conveyed at a reasonable figure to the points of consumption. It might possibly pay to light Heathfield and neighbouring places with it; but whether it will be practicable to successfully pipe it to Hailsham, Eastbourne, or Tunbridge Wells, as has been suggested, is a question requiring further investigation. It would certainly be an unexpected step in the great development of gas lighting which has been witnessed in the past twenty years, if the end of the century should see the displacement of an electric-light installation by one of natural gas on the incandescent system.

THE PURIFICATION OF ACETYLENE.

The numerous complaints of contamination of the air which are invariably made wherever acetylene is used for illuminating purposes within buildings, are proof of the urgent necessity for the adoption of adequate purification of the gas. The tendency to produce smuts which acetylene displays, can indeed only be overcome by the use of suitable burners; for it rests on the extremely high proportion of carbon which the gas contains. No purification is capable of affecting one whit this inherent property of acetylene; for a reduction of the high carbon content of the gas, from which its tendency to smoke arises, would mean the destruction of the acetylene, and the substitution therefor of some other and less highly illuminating gas. Purifying materials which are described as preventing the smoking which is apt to occur when the gas is burnt, should therefore be thoroughly discredited. Recently one material much advertised on the Continent, for which such claims were made, was found by Dr. Odernheimer to be merely Laming's purifying material which has been used for years for the purification of coal gas, and consists chiefly of ferric hydrate. This material would remove from the acetylene sulphuretted hydrogen and ammonia; but it would not affect the inherent tendency of the gas to choke burners, and give a smoky flame. This tendency can be combated only by the use of burners of special design.

The contamination of the air by the combustion of acetylene arises, however, from the products of the combustion of the impurities it contains. The most objectionable of these impurities are ammonia and phosphuretted hydrogen. Both these substances attack metals—especially copper and its alloys—and hence cause corrosion of fittings which is not observed when the acetylene is pure. Ammonia and sulphuretted hydrogen can, of course, be easily removed from the gas by means of ferric hydrate; but neither this nor any common purifying agent removes phosphuretted hydrogen. The method of estimating the latter impurity devised by Lunge and Cedercreutz (*ante*, p. 1132) has suggested a means of purification. For the estimation of phosphuretted hydrogen, the gas is passed through a solution of sodium hypochlorite; but for the removal of the impurity on a large scale, it is more convenient to pass the gas through bleaching powder, which is, essentially, a hypochlorite of calcium. The hypochlorite oxidizes phosphuretted hydrogen to phosphoric acid, which then combines with the lime of the bleaching powder. The removal of the phosphuretted hydrogen is thus effected; but certain precautions must be taken in the employment of bleaching powder for the purpose.

Dr. P. Wolff, in an article in the "Chemiker Zeitung," states that he found a series of small explosions occur when he applied bleaching powder to the purification of acetylene. On seeking the cause, he found it in the interaction of the ammonia in the crude acetylene with the excess of chlorine in the bleaching powder. There was thus produced in the purifier the extremely explosive substance, chloride of nitrogen, which was the origin of the explosions he observed. The remedy for this state of things was readily found; and Dr. Wolff has now devised a really practicable and efficient scheme for the purification of acetylene. He passes the gas into a good washer, which affords the simplest and easiest means of abstracting ammonia and any sulphuretted hydrogen that may be present. The acetylene thus freed from ammonia may then be safely passed into a purifier containing bleaching powder, which removes the phosphuretted hydrogen. Traces of chlorine which the gas will have taken up from the bleaching powder are then removed by means of lime in a subsequent purifier. The purification thus takes place in three stages: (1) The removal of ammonia by water in a washer; (2) the removal of phosphuretted hydrogen by bleaching powder in a purifying vessel; and (3) the removal of chlorine by lime in a purifying vessel. Incidentally, sulphuretted hydrogen (if present) is removed in the first or second stages, and aqueous vapour is removed in the last. It is essential that the removal of ammonia precede the purification with bleaching powder.

The current impression that acetylene has a penetrating and unpleasant odour is dispelled by Dr. Wolff, who states that the gas after purification according to his scheme, has merely a faint and not at all unpleasant ethereal smell. The lack of the

penetrating odour which the impurities impart to the crude acetylene may be a disadvantage in some instances, since the detection of leaks will be less easy. The gas might be odorized by means of the vapour of some strongly smelling substance, such as carbylamine or amyl acetate, in the same manner as uncarburetted water gas is often odorized. Dr. Wolff, however, suggests that a small proportion of unpurified acetylene might safely be added to the purified gas in order to odorize it; and this addition might be readily made by passing the gas over calcium carbide, when the moisture in the gas would liberate sufficient impure acetylene to give the necessary smell to the bulk of the gas, while the latter would not be contaminated to any appreciable extent. The purified gas when consumed in proper burners would not yield phosphoric acid and the other noxious products which usually vitiate the air of rooms where acetylene is the illuminant.

PERSONAL.

Mr. S. Barlow, of Heckmondwike, has obtained the appointment of Manager of the gas-works of the Bakewell Urban District Council.

The late Mr. John Methven left a gross estate entered for probate at £5062. The Executors are his widow, his eldest son (Mr. J. H. Methven), and his brother (Mr. D. Methven).

Mr. S. Crossland, Secretary and Manager of the Holmfirth Gas Company, has been appointed to a similar position with the Abingdon Gas Company in succession to Mr. John Ely, whose resignation, owing to impaired health, was announced in the "Journal" for the 24th ult. There were about 100 applications for the post.

Mr. F. P. Tarratt, of Leicester, is the successful candidate for the position of Works Manager of the Darlington Corporation Gas-Works, rendered vacant by the death of Mr. J. S. Nicholls, and advertised in the "Journal" for the 10th ult. Mr. Tarratt has been some years assistant at the Aylestone Road works of the Leicester Corporation.

Mr. James M'Cubbin, Engineer of the gas-works at Port Glasgow, has been appointed by the Directors of the Monte Video Gas Company as their Engineer. Mr. M'Cubbin was apprenticed to Messrs. R. Laidlaw and Son, of Glasgow, and was subsequently engaged under Mr. George R. Hislop, of Paisley, in the erection of apparatus in various parts of Scotland. Sixteen years ago, when Mr. Carlow left Port Glasgow for Arbroath, Mr. M'Cubbin secured the appointment as his successor, and has held it ever since. He leaves London on the 25th inst. to take up his new duties in Monte Video.

At the Polytechnic Institute, the "Gas Manufacture" classes are conducted by Mr. Walter Grafton, F.C.S., who not only sends up successful pupils, but imparts to them the knowledge to ensure success in a manner which at the same time gains their respect and esteem. Two years ago, his pupils presented him with a silver salver, as a token of their regard; and after the last examinations, he was asked to accept a handsome dressing-bag, subscribed for by the members of his class. The presentation was made by Mr. Arnould, who testified to the high opinion entertained by his fellow-students of Mr. Grafton's ability as a lecturer, and to their appreciation of his efforts to make the class attractive and successful.

At a critical stage in the municipal history of Carmarthen, the Manager and Secretary of the Gas Company (Mr. B. A. Lewis) placed his knowledge and experience in sanitary work and in several branches of engineering at the service of the Corporation for some nine weeks, pending the appointment of a new Surveyor. His account has lately been paid; and in referring to the matter, a local paper says the town has "seldom had a better return for money spent." It appears that there are many things still to be set right; but it is freely acknowledged that had it not been for the work done by Mr. Lewis the new Surveyor would not only have had more to do, but it would have taken him, as a stranger, probably months to discover half the things that had gone wrong, and the innumerable causes of inefficiency in the borough arrangements generally.

OBITUARY.

In noticing last week the death of Sir Robert Rawlinson, it should have been mentioned that he was associated with the gas industry of the Metropolis, having been a Director of the London Gas Company from 1872 down to the time of its amalgamation with The Gaslight and Coke Company in 1883. It is somewhat remarkable that his death on the 31st ult. should have been followed by that of the Secretary of his Company (Mr. A. J. Dove) on the succeeding day.

Following closely upon the removal by death of the Secretary and one of the Directors of the London Gas Company came the announcement last week of the decease, on the 7th inst., in his 74th year, of the Hon. Henry Lewis Noel, who was elected to a seat on the Board of that Company in October, 1873. When the amalgamation with The Gaslight and Coke Company took place ten years later, he was chosen by his colleagues to represent the interests of the London shareholders in the Court of the larger undertaking; and this position he held till his death. He was Chairman of the Cape Town and District Gas Company; and it may be remembered that at the meeting of the Company on the 31st ult. his place, owing to the illness from which he was then suffering, had to be taken by Mr. J. E. Lilley.

In the "Journal" last week, we briefly recorded the death of Mr. Daniel M'Callum, the Engineer of the Omagh (Co. Tyrone) Gas-Works, which took place at the works on the 28th ult. We have since received the following particulars of Mr. M'Callum's life. He was born near Belfast, and after leaving school he was apprenticed in the meter-shop connected with the gas-works in the town. After the completion of his apprenticeship, he remained on in the service of what was then the Belfast Gas Company (as a Meter Inspector and in other capacities) until 1850, when he was appointed Manager at Omagh. He superintended the erection of the gas-works there; and the town was lighted with gas for the first time in December, 1850. Omagh is a town of considerable importance, being the county town of Tyrone, and therefore containing the Lunatic Asylum, the Prison, the Infirmary, and the Barracks. All these had to be lighted with gas; and therefore more was burned than the population of the town would indicate. At first the works were of modest proportions, with one small gasholder, two purifiers, and condensers of limited dimensions. The retort-house also was small, with only six retorts; and, indeed, everything connected with the works was in miniature. Still the plant was sufficient for the requirements of Omagh, the population of which was then about 3000. From time to time the plant was increased; further storage for gas was provided in the shape of an additional holder, and a larger and more roomy coal-shed was erected. A gasholder was also put up at the Asylum, which is situated about one mile from the town. About the year 1890, Mr. M'Callum induced the Directors of the Company to expend about £2000 upon extensions; and he accordingly prepared plans and specifications for the erection of what were practically new works, which were completed about two years ago. The first old gasholder was taken away, and two new ones (of 10,000 and 13,000 cubic feet capacity respectively) were erected. The second holder (of 10,000 cubic feet capacity) which was put up during the existence of the old works is now in use. A new retort-house was built, with benches for fifteen retorts; and new condensers, new purifiers (four in number), an exhauster and scrubber worked by a Crossley gas-engine, and a station meter, governor, &c., were provided—the result being that, as intimated last week, the whole works are now as perfect as any small works could possibly be. They were all erected under Mr. M'Callum's supervision; and he was justifiably proud of them. Before his death he had often said that his life-work would be done when he had them finished to his satisfaction. He was a broad-minded, tolerant, and most intelligent man, of gentle and agreeable nature, and one who, not only in the gas world but in the community in which he had lived for the past 48 years, will be much missed. He was buried near Omagh, beside his wife (who predeceased him some fifteen years), on the 31st ult.; his funeral being largely attended by thoroughly representative inhabitants.

The Effect of Electrical Apparatus in an Explosive Atmosphere.—Some interesting experiments with electrical appliances in an explosive atmosphere have been carried out in the testing gallery of the Consolidation Colliery, near Gelsenkirchen, in Germany. The dangerous atmosphere was prepared with methane procured from an abandoned working, which provides a gas containing on an average 38 per cent. of methane. A meter was interposed in the pipe-line, and the flow was so regulated that a 6 per cent. mixture was obtained; while it was possible to bring the percentage up to 9 or 9·5, with which a proportion of coal dust could be mingled to produce a highly explosive atmosphere. The tests with ordinary incandescent lamps were the most complete. It was found that naked filaments raised to high incandescence may or may not provoke explosion, and may even remain intact and continue to burn after explosion. In most cases, however, ignition followed the breaking or burning out of the filament, with the accompanying sparking. In these tests, the incandescent lamps were smashed in the explosive atmosphere, while alight, by being dropped on the floor or dashed against the wall. At the first glance over the results of 200 such experiments, no conclusion seems possible. Sometimes the bulbs and filaments broke simultaneously, there was bad sparking, and explosion might or might not ensue. In other instances, the filaments remained intact after the bulb was smashed; and again explosion might or might not follow. It is still to be read in new editions of electrical books that the filament can never survive the breaking of the bulb; though this is a fallacy that was exposed by the French Commission of 1890. The conclusion is that for coal mines stout glasses and wire cages should be used to protect the incandescent lamp bulbs. Low-current lamps are to be preferred. The common portable electric lamp is condemned. Not much was done with arc lamps; but their use was discountenanced. Yet it is admitted that arc lamps have been used with impunity in rubber-works, where the air is saturated with benzine vapour. Wire connections rendered red hot by the passage of the current were innocuous; but anything that produced an arc was dangerous.

COMMUNICATED ARTICLES.

PHOTOMETRIC STANDARDS.

By W. Grafton, F.C.S., of Beckton.

In view of the discrepancy which exists among many experimenters on the Standard of Light, the writer has thought fit to lay bare some presumably unknown experimental results which he hopes may be the means of clearing up the difficulty now existing.

In all investigations relating to a standard unit of light, there must be a starting point before we can determine the power of any light. The candle serves this purpose admirably; and most people understand in a very great measure what is meant by the light of a candle. But for the purposes of a standard, that light is of the utmost importance; for so much depends upon its actual value in the commercial world. Roughly speaking, this light is the same for all candles; but when a standard flame is required, then a definite substance must be employed to make the candle. Without going into the character of the sperm candle as to its manufacture, we need only emphasize the necessity for a wick of definite size, as three strands each containing 23 threads. The departure from a definite size of wick only alters the light given out by the candle.

Having settled upon a special make of candle to use as a standard—as the one now issued and certified by the Metropolitan Gas Referees—it is next desirable to thoroughly understand what is meant by *standard light* from such a candle. Mr. W. C. Young, in a paper read before the Society of Chemical Industry, showed that, by a method of doctoring or manipulation, the candle emitted a constant light. But any tampering cannot be tolerated; and besides one man's idea of trimming a wick might not coincide with the opinion held by another man. However successful the method might appear to be, it is not obtaining from a candle a mean lighting value of such candle. The writer, in a paper on "The Standard of Light," published in the "Journal" in May, 1891, showed that by tampering a candle might easily mislead one; and he further proved that no doctoring was necessary in order to get from the candle a steady lighting value. It is this quantity of light which is the bone of contention; and any experimental data which will once and for all settle what a candle's light is, ought to be accepted as a basis upon which to work.

The question may be asked, What is a candle? and the writer ventures to give an answer which experimental facts furnish. It is the amount of light emitted, and maintained for at least one hour after maturing, from the combustion of 120 grains of sperm fed by a definite sized wick in a quiet but pure atmosphere. Time is the chief factor to consider before one can obtain concordant readings or observations. The Gas Referees used to instruct that it was necessary to burn the candles ten minutes ere making a test, until the writer's experiments were made, which clearly showed that at least 20 minutes were necessary before a candle arrived at its *normal condition*, and not necessarily normal rate of burning. The time was then altered to, and still remains, 15 minutes. Quoting the Referees' Instructions, "The candles are to be lighted at least 15 minutes before the beginning of each testing, so as to have attained their normal rate of burning." Now, according to this instruction, the gas examiner may take a new candle, cut it in two, and light the half-candles for 15 minutes, after which they may burn normally as far as sperm consumption is concerned, and be, according to the Instructions, in a fit state to make a test, which, if made, is a legal test. But no right-minded examiner would hold that such candles are normal—in fact, under the conditions, the time is absurdly short, for the wicks are anyhow, and often with outspreading ends. All candles require a preparatory burning, to ensure the ends of the wicks being free from raggedness, but compact and firm.

Further comment on this instruction is needless; so one may proceed to give evidence that 15 minutes is insufficient time to get the normal light from the candles, when only one test is to be made with them on any one day, and especially the first test of the day, as is the practice in the official testing-stations. Officially, candles are seldom allowed to burn longer than the least time stated in the Instructions; and as this is the case, the preparatory time ought to be increased, with directions to burn all the time in the photometer. Candles cannot be used too gently. Moving them from one place to another should not be allowed—in fact, it greatly reverses any maturing that has taken place; and in some cases they might just as well not have been lighted.

Candles Tested to Ascertain Normal Light.

A Methven unit, supplied with pentanized gas, was used as the standard of comparison. The value of the small slot was taken as 2 candles. The candles were allowed to burn 15 minutes before starting, with 1 to 1½ minutes' interval between each test. The following is the amount of light given out by two candles, when burning from beginning to end without being blown out until the completion of the series. The results are corrected to 120 grains per hour. In the series, the sperm consumptions are given, showing how greatly the rates vary without any considerable alteration in corrected results. The light emitted by candles is influenced by the curvature of the wick, which varies a little each way of the normal curvature, and so producing the results arrived at. If it were possible to maintain a set curvature, no alteration in light value would be found.

Table I.—*Showing the Light yielded by Certified Candles when Burning from Beginning to End. Consecutive Tests made after 15 Minutes' Preliminary Burning.*

[Barometer, 30·03; Temperature of Room, Series I., II., III., 66° Fahr.; Series IV., V., 70° and 78° Fahr. respectively.]

(*a*) No. of Test. (*b*) Light per 120 Grains of Sperm emitted by Candles. (*c*) Consumption of Sperm in 10 minutes.

	Series I.		Series II.		Series III.		Series IV.		Series V.	
(*a*)	(*b*)	(*c*)	(*b*)	(*c*)	(*b*)	(*c*)	(*b*)	(*c*)	(*b*)	(*c*)
1	**2·11930**	41·1	**2·0846**	40·7	**2·0700**	40·3	**2·0703**	38·8	**2·0330**	39·0
2	2·00014	40·8	2·0172	40·9	**2·0668**	40·1	2·0414	38·7	2·0024	39·9
3	1·99950	40·7	1·9634	40·5	1·9964	40·3	2·0116	38·5	1·9918	39·4
4	1·99150	40·0	1·9942	42·0	2·0518	40·8	2·0042	39·1	2·0030	39·4
5	1·99391	40·9	2·0162	41·0	2·0052	40·0	1·9416	38·8	2·0080	39·3
6	2·01450	41·2	1·9906	41·7	2·0170	40·7	1·9732	39·5	1·9879	39·7
7	2·00810	40·5	2·0042	41·5	1·9626	41·9	2·0272	38·9	2·0044	38·5
8	..	..	1·9900	40·4	1·9916	39·9	2·0258	38·3	..	..
9	..	..	2·0010	41·4	1·9768	42·1	2·0110	40·2	..	..
10	..	..	2·0146	40·5	..	..	1·9680	38·1	..	..
11	..	..	1·9882	40·3	..	..	..	..	..	..
12	..	..	2·0152	39·5	..	..	..	..	..	..
13	..	..	2·0226	39·9	..	..	..	..	..	..
14	..	..	2·0236	40·2	..	..	..	..	..	..
15	..	..	1·9712	40·5	..	..	..	..	..	..
16	..	..	1·9724	40·8	..	..	..	..	..	..
Av.	2·0012	40·68	1·9990	40·74	2·0002	40·81	2·0004	38·90	1·9994	39·36

Total Time Candles were Burning.

I.—1 h. 34 m. II.—3 h. 11 m. III.—2 h. 5 m. IV.—2 h. 21 m. V.—1 h. 35 m.

From these figures, it is grossly unjust to accept the first test as representing the *normal condition* of the candle. Especially is this so when a glance down the series of tests is made. Excluding the first test, and in one case the second also, the mean candle light is practically 2 candles in all the series, and gives a total average of all tests as 2·00004. The difference is well within 1 per cent. The mean sperm consumption is 40·16 grains in 10 minutes, or at the rate of 120·48 grains per hour.

There is also another feature about these tests. The varying consumption of sperm has little or no bearing upon the final result; and yet the candle may give, per 120 grains of sperm burned, a variation of 6 per cent. between the first and succeeding tests. Now, no one for a moment can accept the "normal rate of burning" as a guide to lighting effect. If we are to judge of the quality of the candle, it must be only by light emitted for a period of time at the statutory rate; this rate being always as nearly as possible 120 grains per hour. Looking especially at the first and second experiments in any series, there is little or no variation in the quantity of sperm burned, but a change in light value. This change in the amount of light is due to the curvature of the wick not having had time to settle into its normal position. When once in position, the light varies but little per grain of sperm burned. The candle may burn faster at one time than at another; but the amount of light yielded for each grain of sperm is the same. It simply means that if we use up the sperm quickly, so we deprive ourselves of light the quicker, and *vice versâ;* but the light would consequently be less brilliant.

From these experiments, made with unselected certified candles, it is apparent that the candles yield their normal light, at the same time normally consuming the sperm, when they have been alight in a steady atmosphere for at least 20 to 25 minutes. Candles mature quicker in a warm atmosphere than in one at a temperature of 60° Fahr. or under; and they consume less sperm in a given time. This accounts for the benefit found by using an Evans photometer, as against an open photometer; and this is borne out by Series V. Care must be exercised to see that there are no loose threads projecting from the wick, and that no unfused ash falls in the "cups," which is carried up the wick, there to act as secondary wicks, and which will upset the best and most steady of candles.

Many bad tests are due to the candle-balance hanging up; and no balance ought to be used which fails to turn under 10 seconds, at the same time not varying more than 3 seconds between any two of a number of trials. The following is an example of times noted (and by no means the worst) in which a 2-candle balance turned; a couple of shot being used to re-adjust the balance. The candles, though burning normally, may have burned a little faster at one period than at another; but considering the short space of time occupied, there could be no such great error. A balance turned in 16, 20, 20, 19, 21, 21, 26, 18, 23, 25, 18, and 20 seconds. These times represent the period occupied by the pointer of the balance in travelling from the starting line to the zero line ($\frac{3}{8}$ inch). All balances which turn in 4 and 5 seconds reduce to a minimum any error in time occupied. This is of the utmost importance, since if in the operation of making a test the balance turned in 16 seconds on starting, but on the completion of the test it was 26 instead of 16 seconds, it would be equal to $\frac{3}{10}$ of a candle on 16-candle gas that would be lost.

Having determined a standard, it becomes a simple matter to test any light in terms of that unit, without any marked variation

occurring. Using a Referees' pattern photometer—known also as the "Letheby photometer, Tooley Street pattern"—with the Dibdin 10-candle standard fixed to its carburetter in the gas end of the photometer, and supplied with air, and testing it by certified candles at the other end, the following results were obtained. The Dibdin standard was set so that the bottom of the cut-off (2·15 inches) was central with the disc; and it must be allowed to burn at least 20 minutes before making a comparison. A 3-inch flame was at all times maintained in the Dibdin chimney—

I.—Candles allowed to burn 16 to 20 minutes in photometer; 500 tests accord a value to the Dibdin standard of 10·291 candles; candles blown out after making test.

II.—Candles allowed to burn at least 20 minutes; 190 tests accord a value to the Dibdin standard of 10·465 candles.

III.—Candles allowed to burn 30 minutes; 146 tests accord a value to the Dibdin standard of 10·451 candles.

IV.—Candles allowed to burn any time from 20 to 30 minutes; 500 tests accord a value to the Dibdin standard of 10·470 candles.

To give still further proof that separate pairs of candles behave uniformly when allowed to burn about 25 minutes before using them, the following tests in the order of making them are cited: 10·66, 10·37, 10·60, 10·52, 10·47, 10·45, 10·41, 10·50, 10·53, 10·46, 10·47, 10·63, and so on—the mean being 10·505 candles. All tests in any series are standard tests, and comply with the Referees' Notification. Similar results have been found on the Westminster photometer, the ventilated Evans photometer, and the Lambeth Road pattern photometer.

The results obtained in Experiments II., III., and IV., prove conclusively that candles can be relied upon when used properly, and no manipulation resorted to. They further show that the true value of the Dibdin standard is equivalent to 10·462 certified sperm candles, when supplied with pentanized air from a carburetter at temperatures close to 60° Fahr.

On referring to the second report to the Public Control Committee of the London County Council, by Mr. Dibdin, published in the "JOURNAL" on July 10, 1894, it will be found that the above results are more than borne out. Mr. Dibdin and his staff of gas examiners were making tests with candles and the 10-candle standard in different localities supplied with gas by the South Metropolitan Gas Company. The tests are certainly given as comparative; and the writer has extracted a few of the principal figures, as under—

Tests of Uncarburetted Gas.

Portable Photometer Testings.						Official Examiners' Report.
At Board Schools.			At Official Stations.			At Nearest Station.
By Candles.	By Pentane Standard.	Difference in Candles.	By Candles.	By Pentane Standard.	Difference in Candles.	By Candles.
Avg. 14·97	13·68	1·29	15·68	14·37	1·31	15·57

Maximum . . . . . 15·4 − 13·6 = 1·8 candles.
Minimum . . . . . 14·7 − 14·1 = 0·6 "
Mean . . . . . 1·3* "

* This means that the pentane argand is not equal to 10, but to 10·9 legal candles.

Tests of Carburetted Gas.

Portable Photometer Testings.						Official Examiners' Report.
At Board Schools.			At Official Stations.			At Nearest Station.
By Candles.	By Pentane Argand.	Difference in Candles.	By Candles.	By Pentane Argand.	Difference in Candles.	By Candles.
Avg. 14·85	13·70	1·15	16·60	15·50	1·10	16·40

Maximum . . . . . 14·7 − 13·2 = 1·5 candles.
Minimum . . . . . 15·6 − 14·9 = 0·7 "
Mean . . . . . 1·13* "

* This means that the pentane argand is not equal to 10, but to 10·75 legal candles.

Mr. Dibdin, referring to the figures given in his Table III., says: "At the same time as the above tests were made, the gas was tested by candles, and found by the legal standard (candle) to average 15 instead of 13·9 candles, as indicated by the pentane argand. The above results must therefore be corrected in that ratio." By this Mr. Dibdin admits that his standard is 7·9 per cent. more powerful than the average candles he used. To show that we may accept the portable photometer results, his third summary is given: "That the testings by the portable photometer are absolutely reliable."

(*To be continued.*)

THE THREE-LIFT GASHOLDER AT SUTTON.

WITH REMARKS ON CONSTRUCTION.

By F. S. CRIPPS, Assoc.M.Inst.C.E.

III.—*The Holder.*

The three lifts of the holder will now be dealt with. Drawing No. 4 shows the general arrangement of the sheeting and crown trussing. Drawing No. 5 will give the details of top curb, cups, internal framework, roller carriages, &c., together with the lower part of the guide-framing, already described.

Trussing.—It will be noted that the gasholder has a "trussed top." It may be put down as a general rule that, wherever economy will permit, it is desirable to adopt a "trussed" rather than an "untrussed" crown, unless indeed the inner lift is very deep, and so heavy as to give an excess of gas pressure at all times. Undoubtedly, it is more economical to truss the crown in small holders than to put a separate frame in the tank; but the exact size where the trussed top ceases to be the more economical plan, is somewhat difficult to determine. No hard-and-fast line can be drawn; but it is approximately between 140 to 160 feet diameter, and depends partly on the *depth*, as it is obvious that the deeper the tank the greater the cost of a separate framing, whereas the cost of a trussed top is unaffected by the *depth* or construction of the tank—it depends entirely on the area of the crown. In the case of Sutton, a saving of fully £150 was effected by trussing the top instead of putting a separate frame in the tank.

When comparing the two systems (trussed and untrussed), it must be remembered that in the case of a trussed crown the radiating rafters materially assist the top curb, and admit of it being lighter than would be safe with an untrussed crown.

In some cases (particularly in shallow holders), it is necessary to make the inner lift very heavy, to get sufficient pressure of gas; and therefore as the extra weight of metal must be put in, it is well to do so by trussing the crown. The extra weight is then introduced to the best advantage.

Another distinct gain in "trussed tops" is that the gasholder builder does not depend upon the tank contractor for getting the crown true. He has the work entirely in his own hands, so that delays and difficulties cannot arise between the different contractors on this score.*

The trussing for supporting the top of the Sutton gasholder has been designed as light as it can be, compatible with strength and stiffness. It is very simple to construct and erect, as will be seen by an examination of Drawing No. 4. There are no secondary or half rafters; all rafters are exactly alike. The trussing is united at the foot of each king-post, by a wire running round the entire circle, which keeps the frame perfectly erect, and guards against twisting over sideways.

The main tension-rods (which, as a rule, are unnecessarily heavy, and out of all proportion to the strains on them) have, in this case, been made much lighter than usual.

The fourteen main tension-rods are not fixed opposite the standards in the usual way, but under the *intermediate* rafters. It is a well-known fact that the top curb contracts in diameter as each lift cups, thereby drawing off the top rollers from the guides. Hence, if there is any tendency of the rafters to push out the top curb at those points where there are no main tension rods to take the thrust of the rafters, it will only occur at the top carriages, where it is an advantage rather than otherwise, in keeping the rollers up to the guides and counteracting the effect of the contraction of the curb above alluded to.

To admit of tightening up the main tension-rods inside the centre column, a temporary opening was left in the centre pier, which was bricked up afterwards.

Sheeting.—The top sheeting is, in shape, the true segment of a sphere, and is quite *free* from the framing in the centre (for reasons already given in the writer's paper on "Gasholder Crowns"—see "Guide-Framing of Gasholders"). The sheets are arranged radially (not zig-zag), and are No. 10 gauge thick.

All the sheets in each ring are exactly the same width in that ring; no "closers" whatever being required in any of the rings to make up the circle.

The rise of the crown is 4 ft. 3 in., and corresponds with a radius of about 400 feet. This rise is amply sufficient to prevent any overstraining of the riveted joints.

The side sheets are No. 11 gauge thick, and are not attached to the vertical guides.

The outer rows of the top, and the top and bottom rows of the side sheeting in each lift, are, of course, very much stronger (as shown on the drawings), and are attached to the framing.

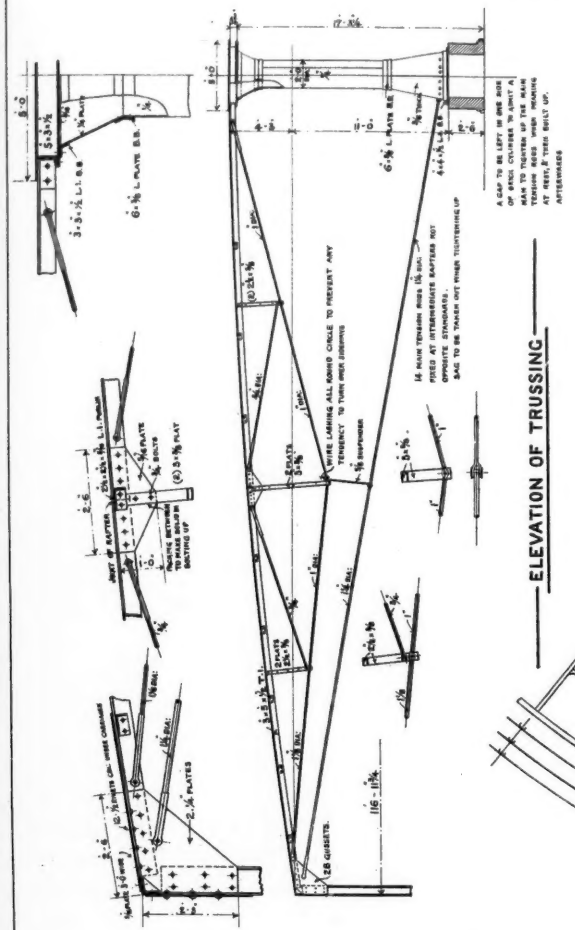
It is the practice now to make the sheets very much larger than they used to be. At one time they were almost universally 4 feet by 2 feet; whereas now they run up to as much as 7 feet by 3 ft. 6 in. The larger the sheets, the less is the total work of shearing, punching, and riveting; and, of course, the chance of leakage is reduced in proportion.

In setting out the side sheets, it is now the rule to put the same number in each lift, and to make the vertical joints come

* The question of trussed and non-trussed crowns and crown sheeting, and the strains on the same, was treated of fully in the author's paper on "Gasholder Crowns,"—see "Transactions of The Gas Institute for 1884," and "Guide-Framing of Gasholders."

THREE LIFT GASHOLDER — SUTTON GAS-WORKS — Nº4.

DETAILS OF TOP SHEETING AND TRUSSING LIVESEY MANLID, DIAGRAM OF SIDE SHEETING &c

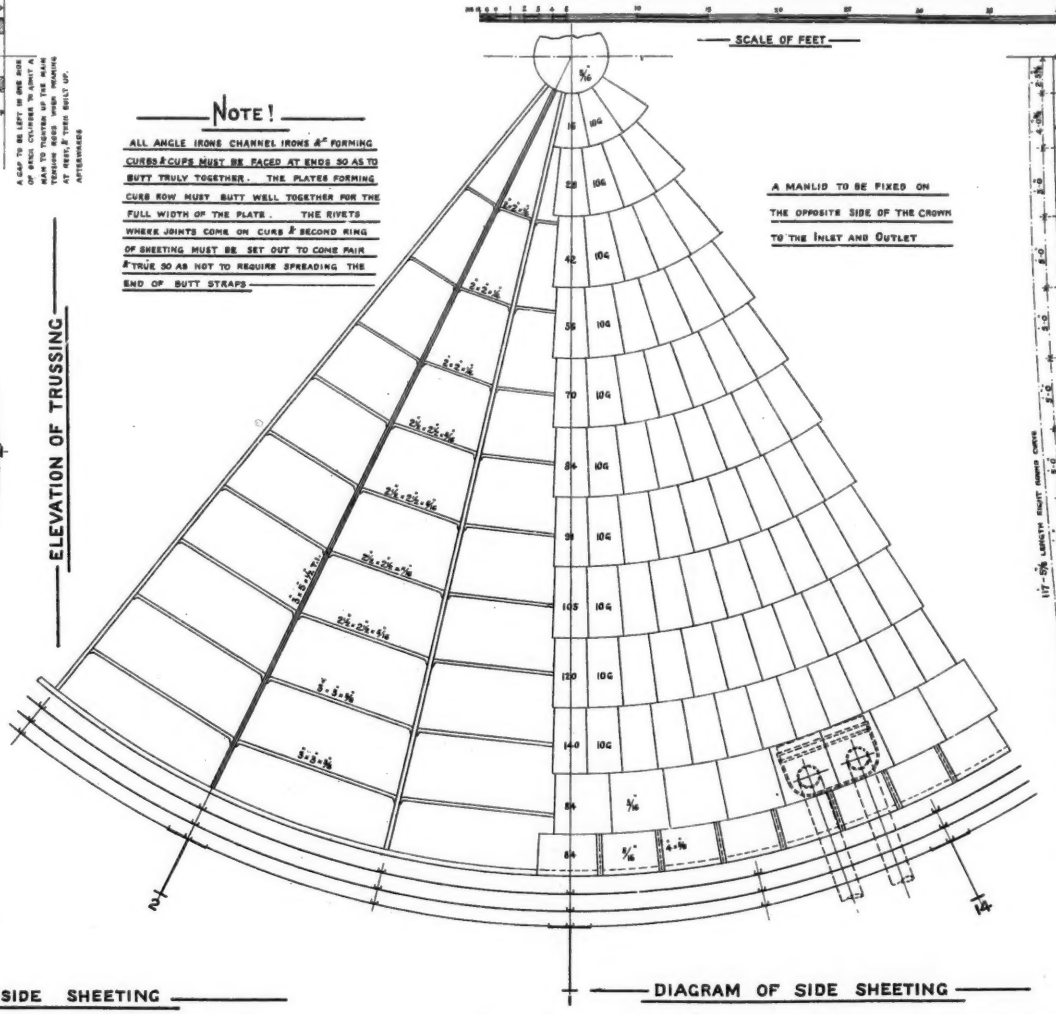


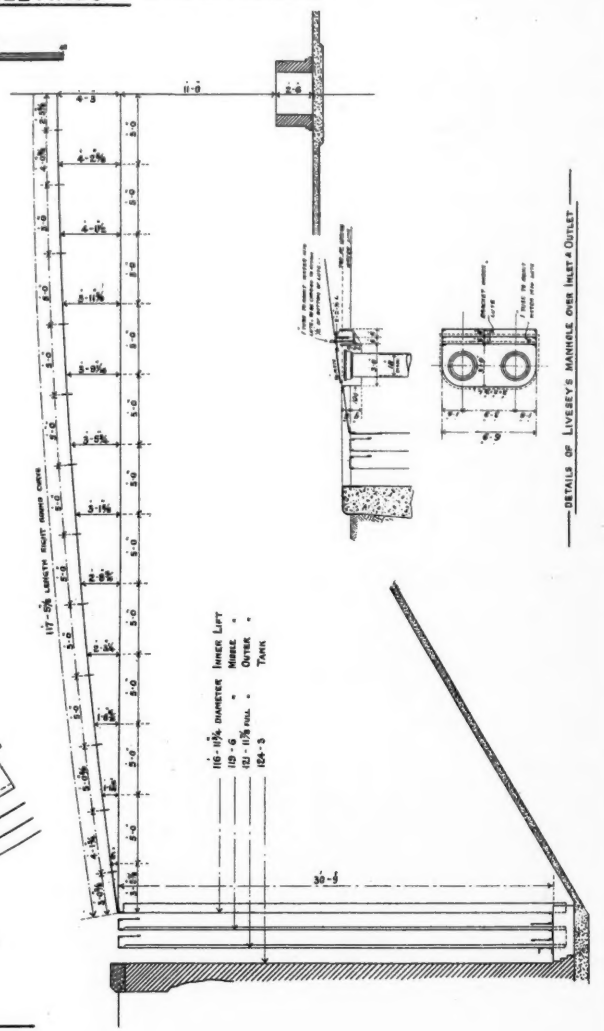
ELEVATION OF TRUSSING

NOTE!

ALL ANGLE IRONS CHANNEL IRONS &c FORMING CURBS & CUPS MUST BE FACED AT ENDS SO AS TO BUTT TRULY TOGETHER. THE PLATES FORMING CURB ROW MUST BUTT WELL TOGETHER FOR THE FULL WIDTH OF THE PLATE. THE RIVETS WHERE JOINTS COME ON CURB & SECOND RING OF SHEETING MUST BE SET OUT TO CONE FAIR & TRUE SO AS NOT TO REQUIRE SPREADING THE END OF BUTT STRAPS

A MANLID TO BE FIXED ON THE OPPOSITE SIDE OF THE CROWN TO THE INLET AND OUTLET





DETAILS OF LIVESEY'S MANHOLE OVER INLET & OUTLET

ARRANGEMENT OF SIDE SHEETING

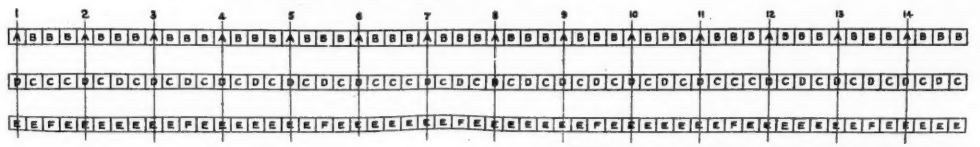
INNER LIFT
DIAMETER = 116 - 11¾ = 4410" CIRC^{E} = 14 BAYS 315" CENTRES

MIDDLE LIFT
DIAMETER = 119 - 6 = 4505 " "

3	321"	1 SHEET	76" = 6-6 CENTRES
		3 "	79 " = 6-7 "
		3 "	80 " = 6-8 "
		1 "	81 " = 6-9 "
11	322"	2 "	80 " = 6-8 "
		2 "	81 " = 6-9 "
7	328"	4 "	82 " = 6-10 "
7	329"	3 "	82 " = 6-10 "
		1 "	83 " = 6-11 "

OUTER LIFT
DIAMETER = 121 - 11⅞ PULL = 4599 " "

DIAGRAM OF SIDE SHEETING


1 2 3 4 5 6 7 8 9 10 11 12 13 14
A B B B A B B B A B B B

immediately behind one another in the several lifts. Also to have an equal number of sheets in each bay—*i.e.*, the number of sheets in the circumference are a multiple of the number of columns or standards. They should also be spaced symmetrically—that is, a joint should come at equal distances on each side of the standard. The number of sheets in a bay should be *even*, so that the intermediate guides and stays may occur on the centre line of a sheet, instead of on a seam of rivets. It is not well to turn the vertical stays, &c., out of their proper place (of equal division), in order to miss a joint, although it is frequently done. The diagram on Drawing No. 4 illustrates the way in which the side sheeting is set out.

In olden days, the sheets were all sent of one size—4 feet by 2 feet—and were allowed to run out how they would, round the circumference; filling up the last space with a "closer," cut to suit. As a consequence, not only did the joints run foul of the proper positions for the vertical stays, &c., but the joints in one lift were always on the twist with the next. In fact, it was an unsymmetrical arrangement, and left a lot to be done by the erector, as best he could, instead of setting it out, and making everything exact at the contractor's works before delivery.

A Livesey manlid (of which a detail is shown on Drawing No. 4) is fixed over the inlet and outlet pipes, as usual. Three manlids are fixed in the lower part of the side sheeting—one in each of the lifts—to afford access to the space between the lifts, when they are at rest, during erection. This is an inestimable boon to the erector. Without this, it is impossible to get between the lifts when they are at one level, on account of the cups.

The Density of Liquid Hydrogen.—Prior to Professor Dewar's recent liquefaction of hydrogen, to which reference was made in the "JOURNAL" for the 31st ult., the lightest liquid obtainable was liquid marsh gas, which has at its boiling-point a density of about two-fifths that of water. Liquid hydrogen has only one-sixth of the density of liquid marsh gas.

Dr. Klein on Bacteriology.—At the Royal Institution on the 2nd inst., Dr. E. E. Klein, F.R.S., gave the first of two lectures on "Modern Methods and their Achievements in Bacteriology." He began by bringing forward some facts to show the minuteness of bacteria, and the rapidity with which they are able to reproduce themselves in favourable circumstances, and referred to the inability of purely chemical analysis to detect bacteria as organic matter, because of their infinitesimal size. Thus a chemist, after investigating water that teemed with bacilli, but contained no other organic matter, might, he said, pronounce it to be of great organic purity. But water containing bacteria alone was a rare thing; and the other extraneous organic matter usually present with them might be discovered by his analysis, and lead him to reject the water as impure. In conclusion, he exhibited a series of slides illustrating how the species of the various microbes associated with diseases, &c., could be distinguished by study of their forms, modes of growth, and other characteristics. In his second lecture, delivered last Thursday, Dr. Klein dealt mainly with the chemical activity of bacteria. He referred to the existence of spore-forming bacilli, and emphasized the practical importance of this fact on account of the enormous resistance offered to inimical influences by some of such organisms. He mentioned a few of the practical results that had been obtained by the study of the action of pure cultures of various bacteria.

Discovery of Another New Constituent of the Atmosphere.—An important announcement was made to the Paris Academy of Sciences, at their sitting on Monday last week, by M. Berthelot, who read a letter he had received from Professor Ramsay announcing the discovery of another new gas which he proposed to call "Krypton." According to the description that accompanied the letter, it belongs not to the argon, but to the helium family; and its density is somewhat greater than that of oxygen—22·5, against 16. At the *Conversazione* of the Royal Society on Wednesday, Professor Ramsay, assisted by Mr. Morris W. Travers, showed the spectrum of the new gas, the official description of which is as follows: "This gas, of which air contains probably not more than 1 part in 10,000 parts of its volume, was obtained by allowing the major portion of nearly a litre of liquid air, kindly provided by Dr. Hampson, to evaporate, collecting the residue separately, and purifying it from oxygen and nitrogen. The spectrum, in which the lines of argon are still feebly visible, shows two brilliant lines—one, the yellow, nearly but not quite identical in wave length with D_3, the characteristic ray of helium; and the other, a brillant yellow green, which Sir W. Huggins believes to be identical with the green auroral line. The density of the gas is considerably higher than that of argon; and it has been proved, like the latter, to be monatomic." At the annual meeting of the Society on the following evening, Professor Ramsay read a paper prepared by himself and Mr. Travers, on the new gas; and the text thereof appears in the current number of "Nature." By evaporating 750 c.c. of liquid air down to 10 c.c., collecting the gas from this residue, and removing the oxygen and nitrogen in the usual way, he obtained 26 c.c. of a gas giving the spectrum of argon, and with it another spectrum which he believed had not been seen before. The two spectra had not yet been disentangled, nor could it be judged what proportion of the residue was argon and what krypton—*i.e.*, "hidden" or "concealed"—as he proposed to call the new element, the scientific symbol of which would be Kr.

TECHNICAL RECORD.

PROFESSOR LEWES ON ACETYLENE GENERATORS.

At the Meeting of the London Section of the Society of Chemical Industry on the 6th inst., under the chairmanship of Dr. R. Messel, Professor VIVIAN B. LEWES read a paper on "The Conditions Existing in Acetylene Generators." A number of diagrams were exhibited; and experiments illustrative of the subject of the lecture were shown during the evening.

The lecturer commenced with a brief review of the history of the electrical manufacture of calcium carbide, and of the acetylene industry. He then said that two prime factors governed the generation of acetylene from carbide. The carbide might be in excess, in which case a great development of heat was possible; or the water might be in excess, in which event the heating effects were less marked. There were two especially dangerous impurities—viz., phosphuretted hydrogen and siliciuretted hydrogen—in acetylene made from commercial calcium carbide; and the quantities of these impurities varied with the degree of purity of the raw materials used in the production of the carbide. Manufacturers of carbide in this country always endeavoured to obtain lime and coke of high quality; and they thus produced a carbide which yielded, relatively speaking, very trifling amounts of impurities. Many samples of carbide manufactured on the Continent were very much contaminated with impurities. Professor Lewes said he had found as much as 2·3 per cent. of phosphuretted hydrogen in the acetylene from one sample of Continental carbide. The average percentage in the gas from a large number of samples of carbide from English, Continental, and American works was 0·6. The phosphuretted hydrogen in the acetylene from English carbide seldom exceeded 0·5 per cent. He had endeavoured to trace a connection between the amount and nature of the phosphorus compounds in the calcium carbide and the amount of phosphuretted hydrogen in the acetylene evolved, but had failed. The phosphuretted hydrogen was extremely dangerous, because, under certain conditions, it inflamed on contact with air. When calcium phosphide was decomposed with water, the phosphuretted hydrogen evolved did not render acetylene spontaneously inflammable; and when the decomposition was effected with solution of caustic soda, 80 per cent. of the impurity was required before the mixed gases inflamed spontaneously. Calcium phosphide was less easily decomposed than calcium carbide by water; and the lecturer had been unable to satisfy himself that the phosphuretted hydrogen in acetylene obtained from carbide was actually derived from calcium phosphide. The amount of siliciuretted hydrogen in gas from good carbide was very small; he had found only 0·01 per cent. in an estimation he had made.

The existing types of generators could be divided into three classes—viz., (1) those in which water flows or drips on to the top of carbide; (2) those in which water rises around the carbide, which is either (*a*) spread on shelves arranged above one another or (*b*) contained in a basket which dips into the water; and (3) those in which the carbide falls into water. In order to ascertain the heat developed by the double decomposition of water and calcium carbide, Professor Lewes had dropped one gramme of carbide into a litre of water contained in a beaker, and had observed the rise of temperature, and therefrom calculated the amount of heat liberated. When the carbide was in one piece, he found 406 calories; when in small lumps, 377 calories; and when finely crushed, 364 calories. Since the carbide used contained only 91·3 per cent. of real calcium carbide, one gramme of the latter should, according to the higher of the three observed values, yield 444·6 calories. Some very similar tests had been made at the Imperial Physical Technical Institute at Charlottenburg, with Continental carbide; and they gave an average of only 260·4 calories for the heat developed per gramme (*ante*, p. 645). It would therefore appear that the Continental carbide contained only about 60 per cent. of real calcium carbide. The heat of decomposition of a gramme of carbide was about one-twentieth of that developed by the combustion of the same weight of carbon.

Professor Lewes had endeavoured to ascertain the maximum temperature attained in the generators of different types. He had employed for the determinations a delicate Le Chatelier thermo-couple. With generators of the first or "drip" class, he had observed temperatures between 400° and 700° C. The gas produced was partially polymerized by the heat. Even at the lower temperatures it contained white vapours of benzene; while at the higher temperatures, tarry vapours were distinctly visible. The generators of the first class yielded about a quarter of the total quantity of gas as "after-development;" and therefore it was necessary to provide a gasholder to accommodate this gas, which was evolved after the water supply had ceased. The only means of avoiding a great rise of temperature and "after-development," was flooding the residue of the carbide. This took place in generators of the third class; but even with these, it was necessary to provide a false perforated bottom, so that the carbide when discharged into the water should be wholly surrounded by it, and should not come in contact with the actual bottom of the generator. The temperature was frequently higher in generators of the second class than

P.S. CRIPPS A.M.I.C.E. ENGINEER. (17 YEARS MANAGER AT WESTMINSTER)
COPYRIGHT.—ENTERED AT STATIONERS' HALL.

in those of the first class. He had observed a velvety deposit of carbon inside those of the second class after use, showing that decomposition of the acetylene had actually been happening. Moreover, the residual lime in generators of the first class had the appearance of ordinary slaked lime; but in those of the second class, it was often distinctly coloured and burnt. Acetylene decomposed at 780° C.; and therefore it was very necessary that the temperature in the generator should not be very high. At lower temperatures, acetylene yielded benzene and tarry products; and these prevented the proper combustion of the gas with a smokeless flame.

Professor Lewes then showed the flame of acetylene in the "Naphey" burner and several modifications of it. He also showed that the addition of benzene vapour to acetylene caused a previously smokeless flame to smoke profusely. He stated that, in order to obtain a good smokeless flame, it was essential that the acetylene should be free from benzene and tarry matters; and therefore it was necessary that a high temperature should not have been reached in the generator. A high temperature was not attained in generators of the third class; and therefore they were preferable to those of the other classes.

Mr. Boverton Redwood, who had assisted Professor Lewes in his investigations on the presence of phosphuretted hydrogen in acetylene, opened the discussion on the paper. He considered that the manner in which the difficulties connected with the generation of acetylene had been stated by the reader of the paper would make the contribution invaluable to those interested in the acetylene industry. Mr. Woerth, of the Acetylene Illuminating Company, also congratulated the author on the value of his paper. He said he had observed that generators of the third class gave a smaller yield of acetylene than did those of the first class for a given quantity of carbide. Mr. Atkinson Butterfield considered that the generators could be more fitly divided into two, instead of three classes. There was a broad distinction between generators in which there was excess of water at the immediate sphere of the reaction, and those in which there was excess of carbide. In the one class, high temperatures were not possible; in the other it was impossible to avoid them. Though generators were usually divided into three classes, opinions varied as to the types which belonged to each class. He called attention to the difference between the temperatures observed in generators by Professor Lewes and those found by Dr. Caro quite recently; and he inquired if the mixture of acetylene and benzene vapour burnt by the author at the same rate of flow as acetylene alone, could not have been made to give a smokeless flame if the rate of consumption had been varied. Mr. R. J. Friswell compared the difficulties that beset the acetylene manufacturer with those with which the organic chemist had to contend in the early days of the preparation of organic compounds. Mr. Otto Hehner suggested a modification of the experiment on the combustion of acetylene saturated with benzene vapour. Mr. Oscar Guttmann spoke on the same point; and Mr. W. F. Reid referred to the use of acetylene admixed with oil gas for railway lighting. Mr. W. A. Bone inquired whether the methane found by Professor Lewes in acetylene generated at high temperatures had been proved to be methane, and not ethane, as experiments he had made on the decomposition of acetylene led him to believe that ethane—not methane—was usually found among the products. Mr. E. Ackermann called attention to the necessity for the removal of phosphuretted hydrogen from acetylene, and commended the method of purification advocated by Dr. Wolff (see p. 1375).

Professor Lewes replied briefly to the questions asked in the course of the discussion; and, on the motion of the Chairman, he was accorded a hearty vote of thanks for his paper, to which he duly responded.

ACETYLENE GENERATORS.

The following is an abstract translation of a paper on this subject by Dr. N. Caro, of Berlin, published recently in two numbers of the "Zeitschrift für Beleuchtungswesen." Reference to this paper was made in the course of the discussion on Professor Vivian B. Lewes's paper on the same subject at the meeting of the London Section of the Society of Chemical Industry on the 6th inst.

The fact that any quantity of acetylene could be produced anywhere by bringing water and calcium carbide into contact was no sooner made known than a host of appliances for generating the gas "in a simple manner" were devised. A series of mishaps showed, however, that the apparently simple process of generation was in reality complicated by a number of attendant phenomena, which could not be ignored in the construction of generating apparatus if risk of accidents was to be precluded. Calcium carbide reacts violently with water, according to the equation: (1) $CaC_2 + H_2O = CaO + C_2H_2$. The products, therefore, are calcium oxide and acetylene. The calcium oxide then reacts with water, and calcium hydroxide results, thus: (2) $CaO + H_2O = Ca(OH)_2$. The two reactions may be written as one, thus: (3) $CaC_2 + 2H_2O = C_2H_2 + Ca(OH)_2$. The reaction occurs quantitatively—that is to say, 64 parts by weight of calcium carbide yield 26 parts by weight of acetylene. The quantitative course of the reaction enables the generation of acetylene to be controlled by regulation either of the addition of water to the carbide, or of the addition of carbide to the water. The addition of water to carbide could readily be exactly controlled according to requirements; and this would therefore appear to be the simplest means of generating a definite quantity of acetylene as required. The completed reaction shown in equation (3), though in reality it comprises the two reactions (1) and (2) which proceed concurrently, affords only two products—acetylene and calcium hydroxide. Professor Lewes has shown that calcium hydroxide has the property of combining with water, and subsequently giving up the water, which thereupon decomposes carbide. At higher temperatures, the reaction shown in the following equation occurs: (4) $Ca(OH)_2 + CaC_2 = 2CaO + C_2H_2$. Thus lime and acetylene result from calcium hydroxide and calcium carbide. Therefore, finally, 36 parts of water can react with calcium carbide to yield 52 parts of acetylene, of which 26 parts will be generated at once and the remaining 26 parts set free by degrees later. This secondary reaction explains the phenomenon of after-evolution, which is observed when water has been added to carbide. Evolution of gas continues for hours after the addition of water has been discontinued, and this after-evolution of acetylene is one of the most troublesome attendant phenomena in the generation of acetylene from carbide.

The reactions by which acetylene is produced from calcium carbide and water are exothermic—that is to say, heat is evolved. The thermo-chemical data for the reaction (3) have been determined by Herr Gerdes; and assuming that the specific heat of calcium hydroxide is 0·31, and that of acetylene is 0·26, he found that a rise of temperature of 1200° C. (2162° F.) was possible. Granting that his computation is not wholly free from objection, the result nevertheless must be approximately correct, as the reaction of equation (2) alone would give a rise of temperature of 550° C. (1022° F.) to the 74 parts of calcium hydroxide and the 26 parts of acetylene present. Such a great development of heat is highly objectionable, for acetylene decomposes completely at 780° C. (1436° F.). Owing to the endothermic nature of acetylene, its decomposition once initiated may easily spread throughout its mass, and be attended with the usual phenomena of an explosion. The explosive wave is not, however, propagated in pure acetylene beyond the immediate sphere of the initial decomposition, provided the pressure of the gas does not exceed 2 atmospheres. Provision should be made to prevent undue rise of pressure in all acetylene generators, as under pressure acetylene behaves exactly as an explosive. Therefore it becomes necessary to provide accommodation for the gas which arises through the after-evolution when a given amount of water decomposes carbide; for this slow evolution continues for hours and days, and may cause a great rise in pressure if the gas is not conveyed from the generator. *A gasholder, therefore, is absolutely necessary in every acetylene installation.*

MM. Berthelot and Vieille found that the explosive wave, though not propagated beyond the immediate sphere of decomposition in *cold* and *pure* acetylene, was propagated throughout the mass when the acetylene was strongly heated, and that the tendency of the gas to explode was much greater when the impurities which commonly occur in commercial acetylene were present. Among other properties which influence the production of acetylene, carbide possesses that of being extremely hygroscopic. It eagerly absorbs water vapour, and thereupon evolution of acetylene, with rapid and concurrent rise of temperature, occurs.

How do the generators in use, or devised for use, stand with regard to the conditions enumerated above? The generators may be ranged in three classes. To the first class belong apparatus in which water flows on to the carbide, and the flow of water is discontinued at pleasure or automatically. To the second class belong apparatus in which at intervals a certain quantity of water decomposes all at once a certain quantity of carbide. To the third class belong apparatus in which a certain quantity of carbide is dropped into a greater quantity of water and is decomposed therein.

The chief representatives of the first class are the so-called "drip" generators, in which water drops continuously on to carbide in a container, or rises from beneath on to carbide on the bottom of a sieve, so that each drop of water brings about a corresponding evolution of acetylene. The drip generators are usually furnished with a device for shutting off the supply of water; and this device is usually actuated by the bell of the gasholder so that the supply of water can be regulated precisely in accordance with the consumption of gas. This method of generating acetylene gives rise to a heavy after-evolution, because the inflowing water meets an excess of carbide, and after the primary reaction is completed the calcium hydroxide produced reacts with the excess of carbide and causes evolution of acetylene. Therefore, in order to avoid the great rise of pressure which otherwise would occur, the installation of a gasholder is absolutely necessary. Of even more importance than the after-evolution is the great rise of temperature which occurs. The heat developed by the reaction is partially lost by radiation and partially spent in vaporizing any water which may be in excess, so that a lower temperature than that which is theoretically possible is actually found. But practical tests show that the actual temperature may easily surpass,

the limits of safety. The author made 26 experiments with a 5-light generator. Small plugs of alloys melting at different temperatures were employed. Throughout the 26 tests the alloys which melted at about 120° C. (248° F.) were completely fused. In three experiments those melting about 216° C. (421° F.) were fused; and in two experiments the alloys melting at 240° C. (464° F.) also showed signs of fusion on the surface. The temperature of the gas in the generator was observed by means of a maximum-recording thermometer. In two cases 160° C. (320° F.) was reached; in most cases it ranged from 60° C. (140° F.) to 110° C. (230° F.). The temperature of dissociation of acetylene is, as already stated, about 780° C. (1436° F.); and in a small generator a temperature of 240° C. (464° F.) was actually observed. A rise of temperature to the dissociation point is not impossible; but it is well within the range of probabilities. If such a rise of temperature takes place, an explosion will ensue, as the dissociation spreads readily throughout the highly heated gas. Evidently there is a hidden danger in the "drip" generators; and their use should be prohibited in all cases.

The "dip" generators, of which there are two types, also belong to the first class. The first type has attached to a movable gasholder bell a basket containing carbide, which dips into the water when the bell sinks, and gives rise to an evolution of acetylene which thereupon raises the bell with its attached carbide holder. The second type has a carbide container attached to the underside of a shallow bell which dips in a water-receiver. When the water flows in, there is evolved acetylene, which forces back the water from the carbide and out of the bell; when the pressure falls owing to consumption of acetylene, the water again rises and comes in contact with the carbide, and thus causes a further evolution of the gas. At first sight, the "dip" generator appears to have a great advantage over the "drip" generator, because a great quantity of water comes in contact with the carbide. This should apparently prevent excessive rise of temperature, as a portion of the heat of the reaction would naturally be taken up by the water. In reality, however, the generation of the gas does not take place under such improved conditions. In both types of "dip" apparatus, water touches the carbide only momentarily; the carbide absorbs water, acetylene is evolved, and the water is immediately driven away from contact with the carbide. The absorbed water then acts on the carbide, which is now in excess, just as in the "drip" generators; but the reaction takes place between greater masses, and the generation happens freely on all sides of the carbide. The result is that the development of heat is even greater. Among 10 experiments with "dip" generators, alloys melting at 240° C. (464° F.) were fused in two cases, and in one instance an alloy melting at 280° C. (536° F.) showed signs of fusion.

The risk of explosion of the acetylene is somewhat diminished in the "dip" generators, because the evolved acetylene can occupy the whole capacity of the bell. There is, however, another factor which indicates a greater risk with this type of generator. The explosive wave is readily propagated beyond the immediate sphere of the explosion in impure as well as in overheated gas. The acetylene made from commercial carbide contains about 0·5 per cent. of impurities, of which one is phosphuretted hydrogen. Calcium phosphide is present throughout the mass of the carbide, and gives off phosphuretted hydrogen while the acetylene is being evolved. Curiously enough, however, when the acetylene is generated in a "dip" apparatus, that produced in the first moments contains much above the usual proportion of phosphuretted hydrogen. It appears that the absorbed water preferably in the first few moments evolves phosphuretted hydrogen from the phosphide. In all cases, the author found that the gas evolved in the first moment in "dip" generators contained 0·5 per cent. of phosphuretted hydrogen; and in one case he observed 0·8 per cent. This was from a carbide which yielded acetylene containing, on an average, only 0·038 per cent. of phosphuretted hydrogen. The high proportion of this impurity in the gas first evolved undoubtedly increases immensely the risk of explosion; and in this respect the "dip" generators are inferior to the other types. With the "dip" as well as with the "drip" generators there is great danger of explosion; and therefore their use should be unreservedly prohibited.

The variety of generators in the second class may be roughly divided into those in which the carbide is contained in separate receptacles placed above one another while the water rises up and floods the receptacles in turn, and those in which the carbide is contained in receptacles placed alongside one another and provided with an overflow from one to the next. In all generators of the second class, the carbide in each small receptacle is flooded by a relatively large quantity of water, and the whole of it is decomposed at once. The evolution of gas takes place boisterously, and in sudden rushes; therefore it is absolutely necessary to use a gasholder, in order to avoid dangerous increases of pressure in the generators. An excessive rise of temperature can only occur momentarily, as the carbide is surrounded by an excess of water which effectually diminishes the heat developed by the reaction. When the carbide receptacles are disposed side by side, however, the water flows from one into the next before the decomposition of the carbide in the first is completed; and the overflow at first is small. Thus the conditions resemble those existing in generators of the first class. The author has indeed observed a rise in temperature of 210° C. (410° F.) in a horizontal generator of the second class. The generators where the carbide receptacles are placed one above another are undoubtedly preferable to those in which they are ranged side by side.

Both types have one fault in common—viz., the after-evolution of gas is very heavy. The after-evolution does not arise through the reaction of equation (4); but is due to the action of aqueous vapour on the carbide. The heat of the reaction drives off aqueous vapour, which acts on the carbide in adjacent receptacles. When carbide was stored in a generator over the surface of water for 8 days, it lost 30 per cent. of its gas-making value. But when carbide was decomposed in a lower receptacle, that in the upper receptacle lost 40 per cent. of its value. A greater amount of carbide appears to be decomposed by the aqueous vapour in horizontal than in vertical generators of this class, probably because the temperature is higher and the evolution of aqueous vapour greater in the horizontal generators. The use of a generator of the second class is quite reasonable; but a gasholder capable of receiving 40 per cent. of the gas which the carbide in the generator would yield must be used in conjunction with it. In the generators in which the receptacles are side by side, the water should flood the carbide in each receptacle at once, instead of flowing in slowly, as is the case with most of the existing generators of this type.

In the generators of the third class, carbide is discharged into a large excess of water. By this method of generation of acetylene, overheating is out of the question. The quantity of acetylene generated at one time is, however, large; and therefore ample gasholder capacity is essential. No after-evolution of gas from the carbide which has been dropped into the water is possible. In most generators of this class, the carbide receptacles have a number of divisions, the contents of each one of which are automatically discharged in turn into the water. The aqueous vapour, however, has access to the whole of the carbide in the receptacle; and therefore after-evolution does occur. But the amount of the gas thus evolved never exceeds 20 per cent. of the total. In some generators of this class one carbide container only is used; and a portion of its contents is discharged into the water at one time, either through a conveying screw or a valve which is controlled by the movements of the gasholder bell. When a screw is used, all the carbide is accessible to the aqueous vapour, and decomposition takes place; while in the second case carbide appears invariably to stick between the valve and its seat, and thus prevents the effectual closing of the valve. Generators of the third class are quite trustworthy; but care should be taken that a gasholder, capable of receiving at least one-fifth of the gas which the carbide in the container will yield, is attached to each.

A whole series of generators which cannot at the present time legally be used in Germany, has been excluded from the above summary, which otherwise exhausts all the known practical kinds. In the generators referred to, the acetylene is produced under a pressure of 10 atmospheres. No generators in which a pressure exceeding 39 inches of water may possibly arise should ever be employed.

Commercial calcium carbide contains many impurities, of which the chief are phosphide, nitride, and silicide. These bodies yield respectively phosphuretted hydrogen, ammonia, and siliciuretted hydrogen when the carbide is decomposed by water. The phosphuretted hydrogen plays an important part in generators, and, as has already been stated, its production virtually makes "dip" generators worthless. It is a spontaneously inflammable gas, and therefore if air is not carefully excluded from the generator and gasholder, an explosion may easily arise. To this cause a number of explosions must be attributed. Very few generators are so arranged that air is completely excluded from them. A generator in which no rise of pressure or of temperature and no ingress of air could occur would be less dangerous in a house than an ordinary petroleum lamp. The great danger from the mixture of air with crude acetylene does not exist so much in the generator as in the gasholder. The impurities therefore should be abstracted from the gas before it reaches the gasholder. Solutions of a number of metallic salts may be used for the removal of phosphuretted hydrogen from the gas. A good washer should be inserted between the generator and gasholder. The gasholder should be provided with a safety gas-escape pipe leading to the open air, and opening when the pressure in the holder exceeds a small value. The gas issuing from the holder should be dried by passing it over quick-lime, as acetylene charged with moisture rapidly corrodes services and fittings.

Patents in 1897.—The fifteenth report of the Comptroller of Patents, Designs, and Trade Marks, presented to Parliament by the President of the Board of Trade (Mr. Ritchie), has been published. It states that the applications for patents in 1897 numbered 30,958—an increase of 765, or 2·5 per cent., on the year 1896, in which there were 5131, or 20·5 per cent., more than in 1895. But the growth in 1897, though less in quantity, was apparently of a more substantial quality than that of 1896; for, whereas in the latter year the increase was mainly in applications accompanied by provisional specifications, in 1897 it was mainly in applications accompanied by complete specifications, which rose by 677, or 14 per cent., while those accompanied by provisional specifications rose by only 88, or 0·3 per cent. The Comptroller (Mr. C. N. Dalton) concludes his report by a reference to the valuable services rendered by Sir Reader Lack.

GAS-WORKS MACHINERY.

Discussion on Mr. Harman's Paper.

In last Tuesday's issue, we published the paper on the above subject which was read the previous evening at the meeting of the Society of Engineers by Mr. E. A. HARMAN, the Engineer of the Huddersfield Corporation Gas-Works. Several gas engineers were present, and the discussion was a full one; but it was, of course, impossible to deal with all the many classes of machinery mentioned in the paper. The discussion was opened by

Mr. A. F. PHILLIPS (St. Albans), who differed from the author in one or two respects. For instance, in regard to exhausters, Mr. Harman considered it was difficult to maintain a steady vacuum if the speed of the exhauster was reduced. He (Mr. Phillips) had many exhausters running which were automatically regulated on the steam-valve without any bye-pass; and he found no difficulty in maintaining a vacuum sufficiently steady for all practical purposes. As to the suggested introduction of gas-engines for driving exhausters, he had not found them satisfactory—mainly because a gas-engine to work efficiently must be maintained at one regular speed; and this necessitated at times the opening of the bye-pass between the inlet and the outlet of the exhauster to a very considerable extent. Concerning the use of conveying machinery for the transport of material in gas-works, only one design of machinery could be applicable to any particular gas-works. It was very seldom in these days that an engineer was called upon to design an entirely new gas-works. If he had to do so, it would, of course, be very easy to adopt the conveying machinery that was the most efficient. But, generally, he had to adapt the coal or coke conveyors to existing gas-works; and it was therefore quite impossible to lay down any hard-and-fast rule. The remarks upon charging and drawing machinery were particularly interesting; but he feared that Mr. Harman was somewhat sanguine when he spoke of retorts being discharged and re-charged in a few seconds. It was true that later on he spoke of them being charged one a minute. This was exceedingly good work; and in any place in which a retort was discharged and re-charged in a minute-and-a-half he thought the management had nothing to improve upon.

Mr. J. HEPWORTH (Edinburgh) said the one criticism that most of them would apply to the paper was that it was too comprehensive, and did not permit of adequate discussion; but, at the same time, it was one of the most excellent papers that he had heard read on the subject. Perhaps one question that would occur to anyone reading the paper quietly would be, How far, after all, is it desirable to adopt machinery in gas-works? That was to say, what size of gas-works would be the limit at which certain machinery might be adopted. Mr. Harman had given them some evidence of his opinion at all events on this point; but, of course, it was a matter of calculation in each case, and for every engineer, when he went into the matter. There were machines mentioned in the paper which would not be applicable to very small works; but he thought the one conclusion they would all come to was largely summed up in the conclusion of the author himself in the last paragraph of the paper—that they might very properly, and with great advantage, do much better work by the adoption of machinery nowadays than they could possibly do by mere hand labour. Stoking-machines, of course, gave the best evidence of what could be done by labour-saving appliances in gas-works. Mr. Phillips differed somewhat from the author as to the speed at which the charging and discharging of retorts could be performed; but this was a matter of detail. They were much indebted to those engineers who had introduced these machines not only because they made labour lighter and more agreeable, but because they placed gas managers in a better position than they would otherwise have been in for dealing with masses of coal, and, might he not also say, for dealing with men. In reference to the use of gas-engines on gas-works, he noticed that Mr. Harman did not say whether he employed them for working his exhauster. He (Mr. Hepworth) supposed that he did not; for in such large works as those of which he was the Engineer, they had a quantity of poor fuel which nobody wished to buy, and, if they did, they gave a ridiculously small price for it. So that in works of any considerable size, it was found desirable to get rid of this, comparatively speaking, waste fuel—small coke and the like—by converting it into steam; and this did away with the necessity for gas-engines. But for all this, he did not agree with the remarks which had been made as to the irregular working of gas-engines. He had himself used gas-engines on small works, and with the greatest possible success. They were, however, introduced not because it was thought to be an economy, but for special circumstances, and as an illustration of what could be done by such engines, and therefore as a sort of advertisement. Regarding the reference the author had made to the size of exhausters—that was, the point which he recommended as the utmost limit of the capacity of exhausters—he (Mr. Hepworth) was afraid it was a matter that was sometimes overlooked in gas-works. It was infinitely better, if they had to deal with larger volumes of gas than were mentioned in the paper, to have duplicate machines—not only in order to have a stand-by, but for the reasons Mr. Harman had drawn attention to. The author's remarks on the subject of lubricants were also very useful. As to the Temperley transporter, he should like to know if it was in use in many gas-works; he did not see why it should not be. It seemed to be an excellent arrangement, though gas engineers were rather glad to do away with machinery of the sort. They did not care to accumulate masses of coke, as it caused waste to some extent. But where they could not avoid an accumulation, he could not conceive of simpler machinery for dealing with coke than that described. The author had also referred to the use of gas-engines with stoking machinery. He (Mr. Hepworth) was not aware that gas-engines had been so exhaustively tried as to make it quite certain that they were not useful for operating stoking machinery. He had seen them working, in the experimental stage, in a large works in the North of England; but he was not sure until he heard the paper read that the results were so unsatisfactory as to make their use for the purpose undesirable. He was not surprised, because one knew how efficient existing types of stoking machinery were.

Mr. JOHN WEST (Manchester), on the invitation of the President, said he did not think there was much that he could say, seeing that he was considerably interested in some of the mechanical appliances mentioned in the paper. The author had referred to the arduous and irksome character of the work of the stoker. This was the idea that animated him some thirty years ago when he started to try and devise machinery for drawing and charging retorts. He thought he had succeeded in easing the work of the stoker; and he was rather proud of it. Beyond this he had succeeded in reducing the cost of making gas, and had rendered the work more pleasant and manageable than heretofore. When they considered what the time of the gas manager might have been like if it had not been for the application of machinery, he thought all would admit that it was a step in the right direction. Regarding exhausters, like Mr. Phillips, he did not quite agree with the author. He (Mr. West) did not know why gas-exhausters should not be made to work steadily; but perhaps there was a little misconception as to the author's meaning. With the best make of exhausters, there was no doubt they could keep to a very steady gauge. In connection with the exhauster, a good many evils cropped up if they had not a good instrument, and did not work it properly. He believed that difficulties arose which ought to be prevented—such as stopped pipes. There was no doubt that some engineers did try to do more with the exhauster than it was intended to do. He quite believed that the gas should be simply drawn from the hydraulic main—not from the retorts, and that there should be a pressure in the retorts. When he said a pressure, he should say $\frac{1}{8}$-inch pressure, not more if it could be avoided. He very much questioned if that which Mr. Harman had indicated so graphically in the paper really took place. The author pointed out that, if they had a seal of 3 inches, and assumed they had a vacuum of 2 inches, there would be but a 1-inch seal for the gas to work through. If a gauge was put on the ascension-pipe, it would be seen there was not much steadiness about it—it would go up and down very rapidly, but would become steady at the fag-end of the charge. He preferred to have a little seal, and that an ammoniacal seal, and to draw the gas just steadily away from the trough with $\frac{1}{2}$-inch seal, working the exhauster at level gauge, and leaving the gas to fall through the $\frac{1}{2}$-inch seal into the hydraulic main, and then draw it away. Mr. R. O. Paterson, of Cheltenham, avoided the hydraulic main altogether, and used a dry main. In his case, he had a steam-jet exhauster; and it worked very steadily indeed. He believed Mr. Paterson's idea was to work with 100th part of an inch pressure on the retort. He had a very large King's gauge, and certainly worked very carefully. He obtained most excellent results both in regard to volume of gas per ton of coal and quality. He thus avoided what Mr. Harman had spoken of—that was, the drawing upon the retort itself. He had seen the machinery for unloading coal at Copenhagen which Mr. Marshall described at the last meeting of the Institution of Gas Engineers; but it was much too large a plant for moderate and small sized gas-works. It would only be applicable where considerable quantities of coal were dealt with. Speaking generally as to coal elevation and conveying, he said there was no doubt a great future for such systems. He believed he erected the first coal-conveyor in England some twenty years ago. That was at the Folkestone Gas-Works, under the late Mr. Thomas Hawksley; and when he (Mr. West) saw it a few months ago, it was still working perfectly. Since then, he had put up a large number of both coal and coke conveyors—in fact, his Company now had works where they did nothing else but deal with this class of machinery.

Mr. J. L. CHAPMAN (Harrow) said he represented only a moderate sized works, and therefore machinery hardly came into the question. It was very difficult to know the time when it was wise to change from hand labour to mechanical stoking. The author had referred to the maintenance of machinery; and in this respect moderate sized works found a difficulty which larger works did not experience. Large works could afford to keep good fitters and mechanics at good wages to reinstate and repair ordinary machinery; but in medium-sized works, they had much trouble in getting the right men down to keep the works in a state of repair. As to the recovery of the waste referred to by Mr. Harman, it seemed almost impossible to utilize some of the waste of small gas-works to such an extent as to get any benefit out of it. They might spend a sovereign to get sixpence. In larger works it might be feasible to do something of the kind; but so many of the minor residuals (if he

might so term them) from gas-works were practically of little or no value. The works round about London were beginning to experience great difficulty in finding an outlet for their gas lime. The London Gas Companies used to make the district where he lived a present of a good deal of gas lime. The District Council, however, were now taking up the matter, and would not have any gas lime deposited in the neighbourhood.

Mr. G. MEAD-ROBINS (Sutton), speaking of the use of gas-engines for driving exhausters, said it struck him that, in the case of small works more particularly, the use of gas-engines would possibly be useful; but, of course, it would depend upon the cost. One found in some small gas-works that having both a gas and steam engine was an advantage. In his own case at the present time, he found a gas-engine was very useful, inasmuch as the price of coke was high. But he thought he should like to know a little more about the working of a gas-engine for this purpose before adopting one entirely. With respect to the coke-breaking machine, he should like to know what the author found to be about the average cost per ton for breaking under ordinary conditions; also the percentage of breeze, and whether he used one or two sieves under his breakers.

Mr. J. TYSOE (East Greenwich) said the author had spoken of exhausters not being designed of sufficient capacity to deal with the maximum make of gas. He was suffering at the present time through a mistake of this character. The works of which he was in charge were designed some years ago for a certain maximum make. A maximum make was assumed; and one pair of exhausters was put in for each retort-house. At that time, the whole of the work was done by hand labour; and machinery, he thought, was hardly then contemplated. Since the installation of machinery (which they had gone in for on a large scale) the make of gas—he would not say the total make per twenty-four hours had increased largely, but the make of gas during certain periods of the twenty-four hours had increased through the effect of the machinery. The charges were put in with great rapidity compared with hand work; and the consequence was that, for the first portion of the charge, the gas came off in large volume, and the exhausters were not sufficient to deal with the gas then made. Fortunately, they were extending, and they were always ahead of their requirements; so that they had now exhausters which had been put into position for future use coming into operation. They always took care to have the exhausters right before the other parts of the works were ready. As to exhausters being driven by gas-engines, this was not the orthodox method on gas-works; and perhaps for ordinary exhausters—that was, the exhausters used for drawing gas from the retort-house—it was not altogether desirable to employ gas-engines. But he might say that at the East Greenwich works, they did use them in connection with exhausters for driving gas from the works to other stations. A large proportion of the gas made there was required for other districts, and had to be sent into the holders supplying them. In the winter time, a sudden demand might be made upon the East Greenwich works; and a gas-engine could be got ready for working the exhausters in certainly not more than ten minutes or a quarter-of-an-hour. These exhausters being some distance from the works and from the boilers, it was thought more economical to arrange to drive them with gas-engines; and they had met with every success at a regular speed. They had a 12-horse power gas-engine driving a pair of exhausters; and the quantity of gas delivered was 440,000 cubic feet per hour. This was an instance of the satisfactory employment of gas-engines for driving exhausters. He had seen on the Continent the coke quenching and conveying machine which the author had described; and he, as well as others who saw it, were struck with its remarkable success—in fact, he had never seen a better arrangement for the purpose. The author had given them sundry figures with which he ventured to join issue to some extent. In speaking of the heating of regenerative settings, he stated that it was customary to reckon that 12 to 15 per cent. of the coal carbonized was required for fuel, or 23 per cent. of the coke made. This was putting it at rather a high figure, because in most works where they had economical furnaces 15 per cent. of the coke made was as much as should be used. In his own case, it came out to between 14 and 15 per cent.; and he knew of many works where this figure was closely adhered to. Speaking of lifting apparatus for purifier covers, he thought perhaps it was somewhat of a refinement to go in for hydraulic power. At East Greenwich, they had large purifiers 90 ft. by 30 ft., with covers weighing 26 tons; and the whole of the lifting and lowering was done by hand labour by means of an overhead traveller. The whole of the purifying operations were carried out by piecework; and the time taken by the men in removing and returning the covers was included in the piecework. They would therefore realize little, if any, saving by an expenditure on hydraulic plant and the paraphernalia connected with it. The author had spoken of the large amount of gas wasted when the retorts were opened. There, again, he thought that a great deal too much was made of the supposed advantage of rapidly closing the retort-lids. The amount of gas that came off the first half minute or so could hardly be called gas. If it did get into the ascension-pipe, it only meant there would be a small proportion of gas in it, and probably a small proportion of tar, which would hardly be worth consideration. The author also spoke of 6 to 8 cwt. of coal per charge being put into the retorts by hand labour. His (Mr. Tysoe's) retorts were charged with 6½ to 7 cwt. of coal. With the large charge of 7 cwt. (he never went to anything like 8 cwt.), the make of gas was reduced as much as 100 to 150 cubic feet; but on reverting to 6½ cwt., it was greater. This was not only his experience but the experience of others with whom he had come in contact. It was rather an important point; and he did not know whether the author had any figures bearing upon the matter. He should like to know the size of the retorts into which he put 8 cwt. of coal. It seemed to him an unheard-of quantity to carbonize in one retort. It also appeared to him (Mr. Tysoe) that a great deal too much was made of the fact, or the supposed fact, that, when machinery was introduced, a larger make of gas per ton of coal was obtained, and more coal was put into the retorts. He was bound to say this was not in accordance with his own experience. At his works by the introduction of machinery, they had saved upwards of £10,000 a year compared with hand labour; but he could not attribute any portion of the saving to the effect of the machines putting in more coal. He thought it was a mistake to place to the credit of the machine any saving as being due to greater charges. If hand work was properly done, it was just as easy to put in a large quantity of coal as a small one. Where machinery had been introduced, and the hand work had been carried on in an unsatisfactory manner, the machinery would, of course, show to greater advantage. As a general rule, he failed to see that credit should be given to machinery for increased make per ton of coal.

Mr. G. P. LEWIS did not think that machinery in gas-works received proper treatment—particularly in regard to lubrication. It was a very difficult thing indeed to get a stoker to understand that a machine required oiling. This was especially the case with regard to locomotives. Ordinary drivers of locomotives were very careful in the cleaning of their engines; but in gas-works there was so much fine coke about, which lodged on the slide-bars, that there was a very rapid wearing away of the surface. There was another point in connection with gas-works machinery. The makers of elevators and machines of this class provided safeguards for their proper working. But these safeguards prevented the men who were unloading or otherwise, particularly on piecework, getting over the task so quickly as they might do; and consequently, unless closely watched, the safeguards were frequently removed. For instance, in the case of the governor on the steam-engine of the elevator, if it was not securely fixed, it would be found that the pin of the governor would be taken out, and the elevator would be run as hard as possible. The result was that, supposing a part of the coal fell off, with the elevator revolving at great rapidity, a breakdown would sometimes result. There was certainly room for improvement in the treatment of machinery in gas-works. Another point of much interest was as to inclined retorts. He thought that in future, if it should be found that the inclined retort system was an advantage, there would be a great revolution in the design of retort-houses and their machinery. They might also look forward to some improvement in purifiers. In America, there seemed to be an idea of developing a new kind of purifier for oxide; and, judging from the drawings, there was no doubt that a very considerable improvement was possible in the construction of purifier-boxes, and in the reduction of labour. As to the question of waste, there was not nearly the amount of waste with regard to breeze that the author seemed to indicate. As a matter of fact, about six years ago, most of the London gas-works had mountains of breeze; but, at the present time, he thought it would be difficult to scrape together a truck-load. There was now an immense demand for this breeze for brick burning, boiler furnaces, steam-launches, and for certain large establishments. Breeze also came in for making concrete; but wherever it was used for this purpose, it should be kept very carefully away from fire. In a case where fine breeze concrete had been used in a boiler-house, the clinker was tipped out on to the surface of the yard which had been made up from refuse gas material containing an amount of small coke. A mysterious fire occurred which ran underground, and attacked the boiler-house foundation, which fired and completely disappeared into powder. This was a danger that would have to be considered in using fine breeze concrete.

Mr. J. C. BELTON (Redhill) differed from the author in some of his remarks with reference to gas-exhausting plant. Mr. Harman seemed to think that the first use of the exhauster was to remove the pressure in the hydraulic main; but this definition was hardly complete, because in many works, the hydraulic main was dispensed with. Were it a fact that the hydraulic main was interposed between the retorts and the exhauster, the definition limiting the first use of the machine to a reduction of the seal upon the dip-pipes would stand. But such was not the case; and in works where the hydraulic main was dispensed with altogether, as well as in others where the seal was dispensed with during carbonization by means of a suitable valve—the so-called "anti dip"—the exhauster was employed in the first place for the purpose of exhausting or withdrawing the gas from the retorts, or, to be still more definite, for the purpose of creating an equilibrium between the atmospheric pressure and the gas being evolved in the retort. By the use of a good valve upon the ascension or bridge pipe, which closed at the moment of striking the retort-lid, and reopened as soon as the charge was put in and the lid closed, the objectionable drawing in of air at the retort mouthpiece was prevented; and, indeed, where

the exhauster was carefully used there should not be a vacuum in the foul main, to cause either atmospheric air or furnace gases to be drawn in. He might say that he had had the pleasure of conducting a works where this system of dispensing with the hydraulic altogether was in use; and he could speak as to its success. The efficiency of an exhausting plant consisted primarily in its ability to maintain a level gauge upon the retorts—that was, to maintain equilibrium between the atmospheric pressure and the gas; and, secondly, in its ability to do this while overcoming the resistance of the purifying plant and gasholders. Where the hydraulic seal was in use, it was almost impossible to entirely prevent back-pressure. As they had just heard from Mr. West, many gas engineers considered it advisable to maintain a slight pressure in the retort; but that was debatable ground. The back-pressure was always injurious by causing a deposit of carbon in the retort. Variations in the speed of the exhauster invariably acted directly upon the retort where a hydraulic main was not in use. But where a hydraulic main was used, the variations did not act directly upon the retort, but upon the gas in the hydraulic main, and the gauges indicated not the conditions in the retorts, but in the hydraulic main. The state of things in the retorts might be altogether different. Proper regulation of the exhauster was one of the most important factors in modern gas manufacture; and he would have been glad if the author had seen his way to enlarge a little upon this head. Most of the regulating appliances in use presented the objectionable feature of "churning" the gas by passing a quantity back to the inlet of the exhauster to be again drawn through it. Where a direct-driven exhauster was used (and, in his opinion, no other should be used) the steam-pipe of the engine should be fitted with a sensitive governor actuated by the gas in the main at a few feet from the inlet of the exhauster. Carefully adjusted, such a governor presented the most reliable method of controlling the exhauster, and was almost automatic; and, by its means, the use of the hydraulic was altogether dispensed with, with satisfactory results. He thoroughly endorsed the author's desire for a greater use of the gas-engine, especially in small works. But in many works, it was absolutely necessary to have steam at 40 to 60 lbs. pressure or even more; and where this was the case, it was questionable whether a gas-engine would be economical. Mr. Belton concluded with a few remarks on the subject of gas-works waste; expressing the hope that something would be done in the direction of utilizing the waste products.

Mr. HARMAN, in replying to the discussion, said he was fully conscious that the comprehensiveness of the subject had prevented each item being dealt with extensively. It was apparent that a paper on each item would alone meet the case. Undoubtedly, the most important part of a gas-works machinery was that used for emptying and refilling the retorts; and this Mr. West's magnificent machinery was doing more economically than could be done by inclined retorts. To members of an engineering society this would not be surprising; for, after all, the arrangement of the retorts at various angles for discharging and charging with coal made the process purely and simply handwork, and handwork was easily surpassable by machines in most spheres. Although he was not prepared to go in full detail into the cost per ton of the various systems in use, yet approximately for the actual operation of charging and discharging a retort, exclusive of the placing of the coal and the clearing away of the coke, which must in some form or other be common to any system, he made the figures roughly as follows: Hand labour, 1s. 6d. per ton; inclined retorts, 10d. per ton; West's stoking machinery, 4½d. per ton. Regarding Mr. Phillips's remarks as to the rapid driving of exhausters, he (Mr. Harman) gave what he termed the general impression, that rapid driving was necessary to ensure an even vacuum; but still he was open to conviction that slow speeds were compatible with an even vacuum. The whole of his statements as to the charging and discharging of retorts, he had derived from actual experience. After something like fifteen years' experience with stoking machinery, he had found that the speed of working machines was dependent not so much upon the machines themselves as upon the men. The awkwardness of the men when they wanted to show the inefficiency of a machine was very pretty indeed. In reply to Mr. Hepworth, he might say that he had not gas-engines at work at Huddersfield for driving the exhausters; and, regarding the Temperley transporter, it had not, so far as he was aware, been adopted in many gas-works. As to Mr. West's remarks respecting the use of jet exhausters, he had used one of Körting's with much success; but on account of the large quantity of steam which condensed in the condensers, he found it reduced the strength of the ammoniacal liquor to such an extent that he had to use it very sparingly. Mr. Mead Robins asked for percentages of coke breeze and dust made by the coke-breaker. But so much depended upon the character of the coal used whether the coke was hard or soft; and this made a difference in the quantity of breeze—indeed, the variation was so considerable as to make any figures he might be able to give quite worthless for purposes of comparison. Mr. Tysoe had given them some useful information as to the work of regenerative furnaces. He (Mr. Harman) was under the impression that 12 per cent. of the coal carbonized for fuel was a very fair working figure, with good regenerative furnaces; but he mentioned 12 to 15 per cent. so as to be on the safe side. In experimental work, he had got as low as 10 per cent. of the coal carbonized, but never less. The weight of the charge was entirely dependent upon the size of the retort. With hand work, his stokers always used to agree to put in 5¾ cwt. per 20-foot retort; but he found that, as the result of a whole week's work, with West's stoking machinery, 6¼ cwt. had been put in regularly. Mr. Lewis had touched upon an important point when he said that stoking machinery did not always receive proper treatment by the men in charge. He could confirm his views to the utmost, and quite agreed that there was plenty of room for improvement as to the handling of machinery. Stoking machinery generally superseded hand labour, and frequently the old stokers were put to work the machines; while as a rule in engineering establishments, qualified men were put on to work the engines. The employment of rough unskilled labour for working high-class machinery was certainly a most serious feature. If skilled men could be employed, and the stokers put to some other work, there was no doubt an improvement would be effected in the working results. As to Mr. Lewis's remarks on waste, he might say that he had referred to coke dust as being a portion of the waste, and not breeze. As to Mr. Belton's observations respecting the use of the exhauster, his (Mr. Harman's) argument was more clearly expressed than he was able to do it by Mr. West, who stated that it was absolutely necessary to have a slight back-pressure, however small, upon the retorts; and he held tenaciously to that point.

The author was cordially thanked for his paper.

THE DECOMPOSITION OF GAS OIL, PHENOL, AND CREOSOTE BY HEAT.

(*Continued from p.* 1319.)

Experiments with Gas Oil.

The oil used was from Riebeck's works, at Webau. The greater part of the phenol had been removed at the works by treatment with soda-lye of 1·38 sp. gr. But, in order to secure a sample free from creosote, 800 c.c. of the oil was agitated with 200 c.c. of soda-lye of the above strength; and 20 c.c. of crude sodium cresylate was obtained. On repeating this treatment, a further 10 c.c. was obtained, giving a total percentage of 3·74 by volume, or 3·96 by weight, on the oil taken. The oil thus freed from creosote had a specific gravity of ·881. It was of a dark reddish-brown colour. It flashed at about 239° Fahr., and ignited at about 308°. It began to distil at 428° Fahr.; 38 per cent. came over under 572°; 50 per cent. between 572° and 680°; and 8 per cent. between 680° and 716°. The residue and loss on distillation amounted to 4 per cent. Decomposition became apparent at 680° Fahr., and carbon began to be separated in the flask.

A preliminary trial showed that, with the tube heated below 1148° Fahr., much of the oil passed over ungasified; and therefore a higher temperature was employed in the research. In three hours, 106 grammes of oil were gasified, and 47,345 c.c. of gas was obtained; corresponding to a make of 236 c.c. per minute, or 3·94 c.c. per second. The gas was dark red-brown as it issued from the tube; bright brown as it passed from the condensing apparatus; and colourless as it entered the gasholder. There was collected 52·9 grammes of condensed oil and tar, and 47·0 grammes of gas; so that the loss was 6·1 grammes, and therefore 94·25 per cent. of the oil was accounted for. The gas was examined by analysis in the Bunte burette. The estimation of the olefines by absorption with bromine water was checked by an estimation with a Hempel pipette, charged with fuming sulphuric acid. Oxygen was estimated by means of an alkaline solution of pyrogallol, and carbonic oxide by means of a solution of cuprous chloride in hydrochloric acid. The hydrogen in the residual gas was determined by fractional combustion, and the hydrocarbons by explosion. After the explosion the figures for the carbonic acid, contraction, and oxygen consumption were found.

In order to minimize the error due to the absorption of the carbonic acid by water, water was admitted after the explosion at the lower end of the burette until the vacuum no longer caused it to ascend. Then 0·5 to 1 c.c. was forced up, so that when the upper stopcock of the burette was opened there was but a slightly lower pressure within, and one or two drops of water only passed down the walls of the burette. Thus the absorption of carbonic acid by the inflowing water was reduced to a minimum. The carbonic acid was next determined by a solution of potash; the residual oxygen, by means of phosphorus in Hempel's apparatus; and the nitrogen in the residual gas was calculated from the difference between the volume of residual gas taken, and that of the constituents determined. The composition of the gas as shown by this analysis may be further elucidated (1) by determining the proportions in which the different paraffins are distributed, and (2) by calculating the average molecular weight of the olefines.

The volume of the total hydrocarbons or paraffins in the gaseous residue is determined by deducting the volumes of hydrogen and nitrogen in the residue, as found by the methods described above, from the total volume of the gaseous residue. In the gas under investigation 100 c.c. of the gaseous residue consisted of 14·6 c.c. of hydrogen, 10·5 c.c. of nitrogen, and 74·9 c.c. of hydrocarbons. After deducting from the total

volume of oxygen consumed the volume needed for the combustion of the hydrogen, it was found that each 1 c.c. of the paraffins had required for its combustion 2·05 c.c. of oxygen. For a given volume of gas, and a given consumption of oxygen per unit volume, it is easy to find a number of mixtures of hydrocarbons which meet the conditions; but in the gaseous mixture under investigation, it was improbable that any but the lower members of the paraffin series were present, owing to the manner in which the gas had been washed. Assuming therefore that the paraffins consist of methane and ethane only, the oxygen consumption per cubic centimetre accords with the proportions of 96·7 of methane to 3·3 of ethane. From these proportions, the amounts of methane and of ethane in the mixed hydrocarbons in the gaseous residue were deduced.

The mean molecular weight of the olefines and their weight per litre were calculated by the aid of the specific gravity of the gas. The specific gravity was determined by means of a Bunsen-Schilling apparatus; and the value thus found was corrected according to Haber's modification of Slaby's formula,* in order to obtain the specific gravity of the dry gas. This was found to be ·782 (dry air = 1·0); and the weight of a litre of the dry gas was 1·012 grammes. The weight per litre of all the constituents of the gas, except the olefines, was known; and from the analysis, therefore, it was easy to calculate the total weight of all the constituents of one litre of the gas less the weight of the olefines. On deducting this total weight from the weight of a litre of the gas, as found from the specific gravity, the difference gave the weight of the olefines in the gas. In this manner, it was found that one litre of the olefines in the gas weighed 1·514 grammes. This agrees with an average molecular weight of 33·80, and indicates that the olefines consisted chiefly of ethylene, of which the molecular weight is 28·0.

In order to obtain a correct statement of the products of the experiment, it was necessary to allow for the fact that at the start the train of apparatus contained air, and at the end gas; while the gas collected in the holder was contaminated with the air driven out of the apparatus. The weight of gas found, therefore, needed correction. The weight of the gas free from air was calculated by deducting the weight of the volume of air in it; and therefrom the weight of the volume of gas made was found. It was 46·81 grammes.

The following table shows the percentage composition of the gas (free from air), and also the weight of the chief gaseous constituents obtained from 100 parts by weight of the oil:—

—	Composition of the Gas. Volumes per cent.	Parts by Weight from 100 Parts of Oil.
Carbonic acid	0·1	..
Ethylene and homologues (C_nH_{2n})	39·0	26·35 (*a*)
Carbonic oxide	1·7	0·95
Hydrogen	9·6	0·38
Paraffins (C_nH_{2n+2}) Methane	47·6	16·18
Paraffins (C_nH_{2n+2}) Ethane	1·6	
Nitrogen	0·4	..

(*a*) This figure in the original is 27·60; but as the 106 grammes of oil are stated to yield 27·93 grammes of ethylene and homologues (a figure which agrees with the volume in the gas), it should evidently be 26·35, as given here.—ED. J.G.L.

The work of which the results are given in the table, brought to a conclusion the analysis of the gas. Two powerful illuminants—viz., acetylene and benzene—which had been abstracted by absorbents, remained to be determined. Before making the acetylene determinations it was thought desirable to determine the extent to which that gas was absorbed by water, brine, and paraffin oil. The following results were obtained:—

Absorbent. (100 c.c. in all cases).	Temperature.	Barometric Pressure.	Volume of Acetylene absorbed.	Weight of Acetylene absorbed.
	Deg. Fahr.	Inches.	Cub. Cent.	Grammes.
Boiled distilled water	67·1	29·72	97·47	0·105
" " "	53·6	29·72	106·61	0·118
Concentrated brine (1·21 sp. gr.)	64·4	29·57	20·40	0·021
" " "	53·6	29·72	21·00	0·023
" " "	32·0	29·25	22·00	0·025
Paraffin oil	32·0	29·72	103·88	0·120

These results indicate that the absorption of acetylene by both water and paraffin oil is considerable, and cannot be ignored in the examination of gases which have remained over water or have been washed with the oil. In analytical work, brine should be used in place of water as a confining liquid, since it absorbs only one-fifth of the volume of acetylene which is absorbed by water.

For the determination of the acetylene, an aliquot part of the gas made was led through the absorption apparatus already described. The precipitate of silver acetylide was collected from the first three Muencke's bottles, and warmed in a beaker with dilute hydrochloric acid, whereby it was decomposed into acetylene and silver chloride. The silver chloride was taken up with dilute ammonia, thrown down with nitric acid, and weighed. The amount of silver chloride thus found corresponded to 0·2045 gramme for the total quantity of gas; and this amount is equivalent to 15·91 c.c. of acetylene. The gas made, therefore, contained 0·031 per cent. of its volume of acetylene; and 100 parts by weight of the oil yielded 0·0175 part of acetylene.

The benzene in the tar and paraffin oil was next determined. The tar, of which the greater part separated in the fractionating flask which served as the first condenser, was a thin liquid weighing 49 grammes, of which 9·592 grammes distilled over below 248° Fahr. The residue was proved to contain naphthalene, but was not further examined. The paraffin oil, which had been contained in three absorption vessels, had experienced an increase in weight of 5·7 grammes. On fractionating, 3·958 grammes of a clear yellow distillate passing over below 248° Fahr. were obtained. This was mixed with the similar fraction, weighing 9·592 grammes, of the tar. The paraffin oil, when heated, evolved at 86° Fahr. and upwards gases which had been absorbed by it. There was, however, no perceptible separation of liquid condensation products boiling below the boiling point of benzene. Therefore the formation of the higher homologues of methane and of ethylene—such as butane, pentane, and hexane, and amylene, hexylene, &c.—in appreciable amount could not have taken place. Professor Lewes has stated* that the higher members of the methane series can be condensed by absorption in paraffin oil; but the author has found the absorptive power of the oil to be less for vapours of paraffins than for benzene. Experiments in which air was passed through gasoline (distilling between 131° and 176° Fahr.), and then through paraffin oil, showed that about 70 per cent. of the gasoline vapours was absorbed by the oil.

The mixed light distillates from the tar and paraffin oil had a specific gravity of 0·801. A portion was nitrated; and after purification, the nitro-benzene obtained was equivalent to a yield of 5·84 grammes of benzene per 100 grammes of oil gasified. Had this benzene passed into the gas, the latter would have contained 3·74 volumes per cent. of benzene vapour. About two-thirds of the benzene was in the tar, and one-third in the paraffin oil.

The olefines in the distillate were determined by titration of a portion of the distillate with standardized semi-saturated bromine water. The quantity of bromine corresponding to the whole volume of the distillate was 0·3338 gramme; and therefore 100 parts by weight of the oil gasified yielded olefines liquid at the ordinary temperature, which needed 0·315 part of bromine for their bromination.

A sulphur determination was made on a portion of the gas by Drehschmidt's system (which closely resembles the Gas Referees' method); and it was found that 100 parts by weight of the oil yielded 0·209 part of sulphur in the form of gaseous and vaporized sulphur compounds.

The gas was tested against a Hefner lamp, on an Elster photometer bar fitted with the Lummer-Brodhun prism appliance. The following were the results obtained:—

Burner Used	Gas Pressure in Tenths.	Consumption per Hour.	Illuminating Power in English Candles.	Candles per 5 Cubic Feet per Hour.	Consumption per Candle-Hour.
		Cub. Ft.			Cub. Ft.
Oil-gas batswing	7½	1·624	8·77	27·00	0·185
"	9	2·048	11·57	28·25	0·177
"	6	0·777	4·82	31·02	0·161
"	7	1·412	8 95	31·62	0·160
Fishtail	5	1·024	6·31	30·80	0·162

Experiment with Gas Oil and Phenol.

A tentative examination of the results of gasifying a mixture of 90 per cent. of phenol (pure carbolic acid) and 10 per cent. of gas oil was next made. The gas oil was added to the phenol in order to liquefy it; but in the later researches, the phenol was liquefied by heat. In 5 hrs. 20 min., 230 grammes of the mixture was passed into the gasification tube, which was heated to 1470° Fahr., and a yield of 43,750 c.c. of gas obtained. The colour of the gas before it entered the condensing apparatus was at first dark brown, and later dirty white. The gas had the following composition in volumes per cent.:—

Carbonic acid	0·2
Olefines (C_nH_{2n})	23·2
Carbonic oxide	25·6
Hydrogen	16·1
Paraffins (C_nH_{2n+2})	21·0
Air	13·9

The increase found in weight of the paraffin oil absorption bottles was 7·6 grammes; and 3·9 grammes distilled over below 248° Fahr. This was added to the similar fraction, amounting to 7·6 grammes, of the tar. The specific gravity of the mixture was 0·9096; and from it 4·81 grammes of benzene were separated. By further fractionation of the tar, phenol amounting to more than half the quantity passed into the gasification apparatus was recovered; showing only partial decomposition had occurred. Later researches indicated that in this experiment it was chiefly the gas oil which was decomposed, since a large quantity of ethylene was obtained, and scarcely any ethylene is yielded by pure phenol. The gas contained 0·12 per cent. by volume of

* See "JOURNAL," Vol. LXVIII., p. 458.

* See "Journal of the Society of Chemical Industry, 1892," p. 585.

acetylene. The illuminating power could not be determined with the oil-gas batswing and fishtail burners; but a 5 cubic feet Bray burner, at a consumption of 2·648 cubic feet per hour, and a pressure of 63·10ths gave a beautiful white flame, having an illuminating power of 10·5 candles. At the same rate of consumption, an 8 cubic feet burner afforded a light of 13·2 candles; but a 1 cubic foot burner only 1·3 candles.

(To be continued.)

BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

The second paper brought before the members at the recent annual meeting of this Association was that by Mr. R. E. W. BERRINGTON (Wolverhampton); but, in his absence, it was read by the Secretary (Mr. W. H. Brothers). It was entitled—

THE SOURCES OF TOWN WATER SUPPLIES, AND THEIR BEARING UPON THE PUBLIC HEALTH.

In commencing his paper, the author remarked that the sources of town water supplies are lakes, rivers, springs, and wells; and he supposed one might say that the source of all these is rainfall. So soon as the rain reaches the earth, it is exposed more or less to contamination; but this is reduced to a minimum in most of the great natural watersheds of the country. Given a large gathering-ground with an impervious surface, and a suitable lake or reservoir for impounding the water, one can hardly conceive anything better adapted for supplying the wants of a large community with one of the first necessities of life and civilization. Even such a unique storehouse as this, however, needs to be carefully watched and preserved from contamination from mines and manurial dressings, sheep-washing, and sewage pollution. Glasgow, Manchester, Liverpool, and Birmingham are singularly fortunate in being able to acquire such splendid water areas. But what concerns engineers most at the present time is the future supply of towns other than the few fortunate ones, and perhaps also the small towns throughout the country which are not on the line of the main conduits running from the few—very few, and for the most part already appropriated—natural gathering-grounds of the country. There is a little comfort in the fact that, by our large boroughs going a long distance for their water, the supplies left at home will be available for the less ambitious local authorities in the immediate neighbourhood. It may be said that water drawn from the vicinity of heavily populated areas must necessarily be contaminated; but this does not follow at all. It might have been urged with much truth a few years ago, and it is not suggested now that certain districts are above suspicion. But local authorities are no longer found to tolerate cesspools and wholesale pollution of underground water; and the carrying out of efficient drainage works will leave the water in and around towns in a very different state to what it has been hitherto.

For general trade purposes, soft water is to be preferred; and in a large town the saving effected by its use amounts to a considerable sum. Soft waters, however, are not altogether an unmixed blessing. Some such waters appropriate from their gathering-grounds certain constituents which have an injurious effect upon lead, and in this way may become dangerous. Others, though attacking lead, do so for a very short period, and possess the power in themselves of communicating to the pipe a sufficiently protective coating as to render their use safe and reliable. There are, however, a few very marked cases of lead-poisoning resulting from the use of particular waters; and it is probable that this evil exists to a larger extent than is generally imagined. Other soft waters contain an unusual amount of free oxygen, and will attack unprotected iron with such vigour as to fill up a 2-inch or even 3-inch main in a short space of time. The author did not know whether this oxygenation process converts the water into a tonic; but he did know that a few of these waters are some of the most palatable, as well as the very best in other respects. It is curious, perhaps, that while water of this type has such an effect upon iron when cold and unprotected, it is a model water for steam purposes. There are hard waters capable of being economically softened; and, therefore, it is not so much a question of hardness as to how much of the hardness is removable at a payable price. Some people prefer a moderately hard water, and go so far as to say that in towns supplied with very soft water the bone and sinew of the rising generation is not developed to the same extent as in other towns having a hard water. The like result is evidenced—so it is said—in the wretched teeth found in the inhabitants of the former towns. On the other hand, excessively hard waters do favour some diseases; and there is ample evidence of the fact.

There are many important towns drawing their water supplies from rivers; and the greatest vigilance is in consequence exercised by the river authorities. Everybody would desire to see our rivers protected. Rivers are more liable to pollution perhaps than any other source of supply; but, on the other hand, detection is often easier. Water from the head of a river, where pollution is much easier prevented, forms an excellent source of supply, and a favourite practice is to construct a dam across the river valley and impound the water, making due provision for the supply of a specific quantity to the river in the way of compensation water. The interception of the water is not necessarily injurious to the river, because a fairly uniform quantity of water can be poured into the stream; and this, in some cases at least, is better than those periodical rushes and flooding which would otherwise take place. For instance, some towns which used to flood before the Vyrnwy was impounded do not flood now. When rivers enter into populated districts, they become suspicious sources of supply; but no doubt running waters have wonderful purifying powers. No one questions the efficacy of filters to remove suspended and perhaps a few other matters; but there is a decided opposition to a town supply being drawn from a river which is the receptacle for the sewage of thousands of people above the intake of such supply. People may call the objection a sentimental one; but it cannot be got rid of, and must be met. Cholera and typhoid germs will travel long distances above ground and underground in defined and undefined channels. Disease germs are wonderfully prolific. The careless pollution of a water-works well by one of the workmen has produced hundreds of cases of disease; the accidental contamination of another well sent typhoid broadcast through a town. Several river supplies would not bear examination at the present time. On the other hand, water is sometimes needlessly condemned; and people are made to drink water of an inferior quality to that offered. The water supplied to a town must have a direct bearing upon the health of the people; but it does not follow that, because the general death rate and the zymotic rate are low, the water supply is necessarily of the best and purest quality.

Some towns are so happily situated as to be supplied with water direct from springs; and if such springs are at a height to supply gravitation so much the better. There are several small towns in this favourable position; and the quantity and quality of the water are excellent. Springs are frequently unreliable; and they may go on yielding water for years and then suddenly fail almost entirely. This failure may be the result of long periods of drought. But it is due sometimes to other causes; and there are very peculiar examples of failure in springs from hitherto unexplained causes. We read of wells having been dug in very early times; and certainly there is no lack of well-sinking at the present day. Is it, asked the author, possible to say anything new to specialists on this question? No work is, perhaps, more precarious than well-sinking. Even in the recognized water-bearing formations, failures are common; and sometimes wells which are apparently good gradually decrease in yield. Deep artesian bore-holes draw the water from miles around, and empty wells in the vicinity and cesspools too, if they still exist. Brewery and other companies frequently bore in the centre of large towns and find plenty of water. The purifying effect of certain strata is most marked. Water pumped in some districts must be largely augmented by sewage; and it will be some time before such pollution is entirely stopped.

The author's general conclusions were: (1) That, inasmuch as there is no Government control over the few exceptional and large gathering areas of this country, the local authorities must look to local sources of supply. (2) That where water cannot be impounded at a sufficient altitude to gravitate to a town, it is generally possible to find water by boring, and that pumping by modern machinery is much more efficient and infinitely cheaper than it used to be. (3) That it is important to secure a water of good quality as well as one sufficient in quantity. (4) That soft water from moorland districts attacks lead and produces lead-poisoning in numerous instances, and that the water ought to be treated in some way, or some other material in place of lead should be used. (5) That for domestic and trade purposes soft water, other than the moorland water mentioned, is the best, though there may be no particular proved objection to a moderately hard water. (6) That the provision of a good and plentiful supply of water is a sound investment for any town. It is an incentive to commercial development; but best of all it saves life, reduces the illness rate, and contributes in no small measure to the comfort, happiness, and general well-being of the community.

Discussion.

Mr. W. WHITAKER, F.R.S. (Croydon), opened the discussion by speaking of the tendency of late to resuscitate surface supplies by means of shallow wells. Some years ago, he said, so many cases were found where these sources were contaminated, that, with the usual weakness of human nature, people rushed to the conclusion that all were bad. They were beginning to see now that, under proper conditions, some might be good. There were places in country districts where there were no other sources available; and if shallow wells were sunk away from contamination, there was no reason why a considerable supply should not be obtained from such sources. He next expressed a preference for a moderately hard water. It was, however, wrong to say that hard water was better than soft, or soft better than hard; it depended entirely upon the people and the conditions prevailing in the district. There were considerable towns in England having a hard water supply which were among the heathiest. Croydon had been for some years the healthiest in England; and the inhabitants were supplied with a hard water. Still, he hoped the Corporation would soften it a little; so that it was not quite so hard for trade purposes. They all knew that soft water was favourable to lead-poisoning; but he doubted whether hard water favoured any disease if people were at all healthy. At the Portsmouth Water-Works, the members would see the finest exhibition of spring-water supply

in this country. He did not know of any other case where such a large town only took the water that came to them in this way. He could not agree with the author that there was nothing new to say on the question of wells. There was much to be found out in connection with wells—in fact, in his opinion, they were really only on the threshold of what was to be learnt.

Mr. F. J. BANCROFT (Hull) said he came from a hard water district. He believed in hard water, and thought it a questionable proceeding to doctor the supply by reducing the hardness. When they found that a hard water such as the Kent Company's supply only contained 3 bacteria per cubic centimetre, and that the air near the sea coast contained as much as 50 bacteria per cubic centimetre, and in crowded assemblies the number sometimes rose to 1650, it seemed to him a questionable proceeding to take a pure water supply such as was drawn from the chalk, and expose it to atmospheric influences. The subject of Government control of watersheds brought them to the question as to whether the water supply of England was not of sufficient importance now to warrant the establishment of a separate department to deal solely with matters relating to water supply. As far as foods and drugs were concerned, it was the duty of local authorities to see that they were distributed in a pure condition, to the inhabitants; but water was excluded from the operations of the Foods and Drugs Act. In case of a dispute, Magistrates could cause water to be analyzed, at the cost of the local authority, under the Public Health Act. Sometimes in their difficulty, they went to the Government Laboratory at Somerset House. But only recently, the Secretary to the Treasury, in answering a question in the House of Commons, said the Laboratory officials were not expressly sanctioned by the Board of Inland Revenue to give a decision in these cases; and he made the remarkable statement that their report in a certain case did perhaps go beyond their powers. There was nothing in any Act that imposed on a local authority the guardianship of the water supplied by a private company. The same applied to inspection of wells sunk in the chalk. In many places, cesspools were found in the chalk in close proximity to wells.

Dr. KEMNA (Antwerp) thought people who were accustomed to drink a soft water would find hard water objectionable; while those who were used to hard water would find soft water unpalatable. Speaking of the softening of water, he said that, used in large quantities, lime was a costly ingredient for industrial purposes; and it had to be taken out again either in the form of boiler scale or as a precipitate. From a physiological point of view, it had been said that lime had a very beneficial effect. Compared, however, with milk and other liquids which were daily absorbed into the system, the quantity of lime "brought home" by water was exceedingly small; and therefore it could have no effect at all. He thought it better not to have too hard a water; and if he had to choose between a hard and soft water, he should certainly take the soft. On the question of the relation of disease to water supply, he pointed out that where water was drawn from a river, that very fact led the manager to take every precaution; while in the case of a spring supply, the same supervision was not exercised, until the manager was awakened by an offensive return, which showed the water to be dangerous. He referred to towns, supplied both by well and river waters, which had obtained unenviable reputations from the pollution of their supplies.

Mr. C. H. PRIESTLEY (Cardiff) spoke in favour of soft water. He thought it would be admitted that, had it not been for the soft water supplies in Lancashire and Yorkshire, they would not have had the large industries that existed there at the present time. The people of Cardiff had had experience of both hard and soft water for domestic purposes; and they much preferred the soft supply. He considered too much prominence had been given to bacteriological examinations of water of late years as against chemical examinations; and he thought the two ought to go together.

Mr. J. SHAW (Boston, Lincs.) considered the opinions of engineers on the question of hard or soft water were guided very much by the kind they supplied. He was a believer in hard water. A table prepared by Mr. Thomas Hawksley some 30 years ago showed that, as a general rule, towns supplied with hard water had the lowest death rate.

Mr. J. BRIERLEY (Public Analyst of Southampton) thought that for commercial and industrial purposes a soft water was preferable to a hard one. As to shallow wells, he had had water from wells situated underneath houses, and had found it perfectly good. The wells were thoroughly well lined from above the surface of the ground to about 8 to 10 feet deep. Apart from their situation, the purity of the water from wells depended a great deal upon the way they were constructed. Remarks had been made as to the number of bacteria in water; but it was not so much a question of the number as the kind of bacteria.

Mr. W. JONES (Pontypridd) emphasized the remarks made as to the necessity of water supplies being more directly under Government control. Some of the large cities had for a long time past had their eyes on the water of Wales; and, unless Government interfered, he was afraid that not only London but other big centres would sooner or later go to Wales for water. If Government did not interfere, the water would be taken from Wales in spite of any efforts that were put forth by the Welsh people. The Glamorganshire County Council had for several years been taking steps with the object not of preventing London or any other town obtaining a supply, but to secure for themselves a sufficient supply. They had invited other County Councils to assist them—such as Carmarthenshire and Monmouthshire; but more particularly through lack of funds, they had not been able to take the steps that the wealthy county of Glamorgan had done. He considered the Government should assist these poor communities to reserve for themselves that water which was so essential for their life and well-being.

Mr. W. WATTS (Sheffield) was strongly opposed to the centralization of the control of water-works. If engineers did their work faithfully and well with reference to drainage areas, there need be no interference whatever. Many corporations were purchasing their watersheds in order to prevent pollution; and nothing more than this could be done.

Mr. H. ASHTON HILL pointed out that the Bill which was to be promoted by the Municipal Corporations Association proposed that any official of a sanitary authority should at any hour of the day or night have access to all waters, reservoirs, &c., of a company or local authority. Before this became law, he thought the Association ought to have something to say on the point. This was a question that the Committee on Water Boards should watch very closely. They could not object to reasonable supervision; but he thought it should be confined to some responsible officer of a local authority—say, the medical officer of health. Unless this was done, he considered it would be better to remove the supervision entirely to a Government department. He also spoke of the great danger of pure water becoming infected, owing to the fact that bacteria throve in it to a greater extent than in water of less purity.

Mr. W. INGHAM (Torquay) mentioned some tests that had been made with running streams on the Torquay watershed, although they were not used for water supply. When the streams were delivering 4 million gallons per day, it was found that they contained 6000 *bacilli coli* per cubic centimetre; but when the flow was down to 1 million gallons per day, it was found that the water only contained about 100 per cubic centimetre. When some work was being carried out at his upper reservoir (which had a capacity of 200 million gallons), a quantity of dirty water found its way into it. On being bacteriologically tested, it was found to contain 3000 bacteria per cubic centimetre; but after the reservoir had been at rest for something like three weeks, another test was made, and only 70 bacteria per cubic centimetre were found. In the meantime, however, he had allowed a certain amount of the water to flow into the lower reservoir. Before the decantation, the latter contained about 70 bacteria per cubic centimetre; but after turning in the water from the upper reservoir, the number rose to 160. He thought the movement for obtaining some better supervision over water supplies was a step in the right direction. As to the use of hard and soft water, he preferred one of about 4° of hardness. At Torquay, they had purchased the watershed—2300 acres—at a cost of something like £40,000; and he had recommended his Committee to do away with every farm on the estate.

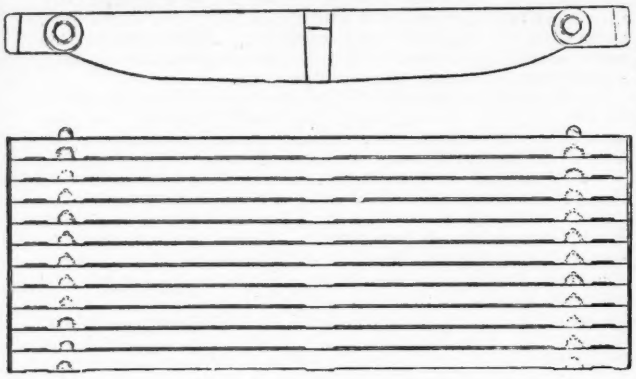
The discussion concluded with a formal vote of thanks to the author.

THE USE OF BREEZE AS BOILER FUEL.

The publication in the "JOURNAL" for the 11th of January of an article on the above subject, giving the results of some trials of the Kudlicz grate at the Nuremberg Gas-Works, under the auspices of the Bavarian Boiler Association, aroused in a certain section of our readers an interest in the question of the utilization of inferior classes of fuel for raising steam. It is now generally recognized by engineers that this is best effected by the adoption of some system of forced draught in connection with the boiler furnace, if the highest economical results are to be realized; in fact, it is practically as indispensable as the chimney. A few figures may be cited in support of the foregoing statement. In order to burn 1 lb. of coal with natural draught, it is necessary to supply at least 24 lbs. of air—double the quantity chemically required to effect its combustion; whereas with forced draught only 18 lbs. are required. Assuming that, with the theoretical quantity of air, a temperature of 4000° Fahr. can be obtained, this will be reduced to 2000° Fahr. with natural draught and twice the quantity actually needed; whereas with forced draught, and using only 50 per cent. more than the theoretical amount, a temperature of about 3000° Fahr. could be reached. Moreover, it enables all kinds of inferior fuels—those which were at one time thrown away, or removed at some expense—to be usefully and profitably employed.

In view of the advantages attending the adoption of this system, it may not be without interest at the present juncture to direct attention to the method of applying it with which Messrs. Meldrum Bros., of Manchester, have been so long identified, and to indicate the improvements they have recently effected. The principle of the system consists in forcing the air for combustion into the ashpit of the furnace by means of steam-jet blowers, which project under the grate. The steam connection is made through the front of the boiler in the steam space. The ashpit being air-tight (the only exit being through the bars), the air is under pressure, which is regulated by the stoker to suit the thickness of the fires and the class of fuel to be consumed. The steam used for injecting the air preserves the fire-bars, and prevents the clinker from adhering to them. The bars are short

and narrow, with an air space 1-16th of an inch. This permits the passage of as much air as is required, and causes it to be regularly distributed through the fuel. This part of the system has been improved by Messrs. Meldrum since they first introduced it; and the bars have now a patent interlocking arrangement, shown in the accompanying diagram. It prevents the bars from being lifted out of position in the act of clinkering, keeps them level, and ensures them a long life.



Another point in which improvement has been effected is in the arrangements made for superheating the steam before it passes to the blowers; thereby ensuring an absence of water or moisture likely to cause corrosion of the flues. With the old type of external blower especially, and to a less degree with the internal one before the introduction of the superheater, this corrosion was a constant source of trouble. The supply of secondary air is drawn from the ashpit, and passes through a valve in the dead-plate over the fire; meeting the gases coming from the freshly-charged fuel, and mingling intimately with the hydrocarbons evolved, the cooling of which is the cause of smoke and waste. The dead-plate is found of great value in water-works and other installations where it is necessary to burn coal, as the smoke is thereby reduced to a minimum.

In August last year some trials of the Meldrum furnace, burning breeze only, were carried out by M. Bougarel, a delegate of the Paris Tribunal of Commerce. They extended over 7½ hours, during which time 1404 kilos. (3080 lbs.) of breeze were burnt on a grate having an area of 1·70 square metres (about 18 square feet). The heating surface was 80 square metres; and 13·6 kilos. (30 lbs.) of water were evaporated per square metre of surface per hour—being at the rate of 5·65 kilos. per kilogramme of breeze consumed. The fuel cost 10 frs. per ton; so that the expense of producing a ton of steam was 1·75 frs., or about 1s. 5½d. Before this furnace was adopted, coals at 24 frs. per ton were burnt, evaporating 7 kilos. of water per kilogramme of fuel; and making the cost of the steam 3·43 frs. per ton. The economy realized was therefore at the rate of 51 per cent.

The Wigston District Council and the Gas-Works.—The Wigston District Council last Tuesday appointed a Committee to approach the Directors of the Gas Company with a view to the acquisition of their undertaking.

Extensions at the Usk Gas-Works.—The Directors of the Usk Gas Company have decided, on the recommendation of their Manager, Mr. F. Hill (whose proposals have been endorsed by Mr. Thomas Canning, of Newport, Mon.), to erect a new gasholder and an additional bench of retorts. For these purposes, the shareholders have authorized the Directors to borrow £1200 by debentures or mortgage. The contract for the holder has been secured by Messrs. W. C. Holmes & Co., and that for the bench of retorts by Messrs. Gibbons Bros.

The Acquisition of the Amsterdam Gas-Works by the Municipality.—The prospectus was published last week of the issue of 3 per cent. bonds to the amount of 17,200,000 florins (about £1,433,333), by the City of Amsterdam, to provide funds for the purchase from the Imperial Continental Gas Association of their existing gas-works and undertaking in Amsterdam. It is stated therein that the income, judging from the results of past years, will be sufficient to provide a substantial surplus towards the municipal revenues beyond the amount required for the service of the loan. The subscriptions are to be at the rate of £95 15s. per 1200 florins (£100), including interest at 3 per cent. from the 1st of April. The bonds range in nominal value from 12,000 to 100 florins.

The Cost of the Artesian Well Water Supply of the Corporation of London.—Readers of the "JOURNAL" will be familiar with the history of the above-named well, which was sunk some years ago to supply certain artisans' dwellings near Houndsditch. The quantity of water raised daily is about 33,000 gallons, or more than 10 million gallons a year. Of this quantity, about 22,000 gallons a day, or 7 millions a year, are used for the purposes of the dwellings; leaving an available daily surplus of 11,000 gallons. The average quantity of water used annually for street watering and washing is 41 million gallons, for which the New River Company charge 9d. per 1000 gallons. The annual cost of pumping the water now supplied to the dwellings is £180, or about 5½d. per 1000 gallons; while the cost of the well has been £5610. The original charge made by the Company for a constant supply was £84 per annum. Consequently the Corporation, by their experiment, have not only sunk nearly £6000, but are losing £100 a year in the expense of supplying the water. There are no means, without great additional expense, of utilizing the surplus daily supply for washing the streets; and therefore the Corporation have decided not to attempt it.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Accident Fund of the South Metropolitan Gas Company.

SIR,—There are one or two considerations arising out of Mr. Livesey's report on the first six months' working of the above fund, to which attention may perhaps be advantageously called, before his figures, and his inferences therefrom, are accepted as forming any basis for future calculations.

The first, and by far the most serious (concerning which you have yourself uttered a word of caution) is as to Mr. Livesey's interpretation of the provision made in the Act in lieu of the exemption from liability for accidents caused by "contributory negligence" of the injured workman, which employers enjoyed under former statutes.

In estimating the amount of compensation for which his Company would have been liable under the provisions of the Workmen's Compensation Act, for the period covered by his report, Mr. Livesey takes for granted that "all those (cases) under Class A, 22 in number, caused by the injured man's gross negligence . . . could claim nothing under the Act." The precise wording of the Act [Sec. 1 (2c.)] should be observed: "If it is proved that the injury to a workman is attributable to the serious *and wilful* misconduct of that workman, any compensation claimed in respect of that injury shall be disallowed."

In this connection, Mr. W. A. Willis, in his excellent handbook on the Act, points out (p. 26) the great difficulty with which such a defence could be set up and maintained; and he makes the following comments on the sub-section: "The Act casts upon the employer the *onus* of establishing the defence; and to succeed in this he has to prove: (1) That the workman has been guilty of 'serious and wilful misconduct;' and (2) that the injury is 'attributable' to such misconduct. The term 'wilful' in its legal sense means 'intentional;' so that it is difficult to see how 'wilful misconduct' can consist of anything short of a deliberate act or omission which the workman knows is contrary to a duty imposed on him by law or by the regulations of his employment. *Gross negligence of itself will not be sufficient*, because negligence, however gross, need not be 'wilful.'"

Is Mr. Livesey able to say that in every one, or even in any considerable number, of the 22 cases classified under his scheme as "caused by the injured man's gross negligence," he could have successfully established his Company's immunity from liability under the Act? If not, he must add the cost of some or all of these to his estimate of the charge their accidents would have been to his Company if they had paid for them on the terms of the Act only. If, on the other hand, he considers he could claim exemption for them all, should he not include an estimate of the cost he might incur in fighting, as he certainly would have to fight, for that exemption?

And that leads to the second consideration—viz., the total saving of legal or arbitration costs gained by the adoption of a satisfactory mutual scheme for compensation. Mr. Livesey has not made any allowance for his immunity from "costs."

Further, is he justified in assuming that the amount paid in pensions to widows, £171 1s., is equivalent to the probable average cost of fatal accidents under the Act? His average of fatal accidents for the six years 1892-7, has been 0·83 per half year. In each case the man has left a widow. Under the Act, this would have cost him: 32s. (average weekly wage) × 156 × 0·83 = £208 per half year.

Lastly, Mr. Livesey speaks with alarm of the large increase in the number of accidents reported since his fund was started. It would help to decide whether this increase is actual, or only apparent, if he would tell us whether the total number of cases of sickness and accidents dealt with has increased to the same extent as the number of accident cases alone has done. In other words, we should then know whether many, if any, of the additional accident cases are merely transfers from the category of sickness, or whether the existence of the fund has helped to manufacture mole-hill accidents into mountains.

G.

June, 9, 1898.

Workmen's Compensation Insurance.

SIR,—I have read with interest your editorial notes, and also letters in your paper on this subject, during the past few weeks.

I quite agree that the rate required by the Insurance Offices who are on the tariff appears excessive for a Gas Company's risk; also that what Mr. Guyatt says in the current issue is very much to the point as to the wording of the policy.

As an Insurance Broker, I have gone fully into the matter, and find it is possible to get the business written at about half the tariff rates; and I think a premium of about 12s. 6d. is fair to all parties. This is the rate I am to-day quoting on a policy which is worded to cover the three risks—viz., Workmen's Compensation Act 1897, Employer's Liability Act 1880, and at common law. Also, if the assured should transfer his "affections" to another office at the end of twelve months the first Company's risk does not cease.

JOS. EDWARDS RIDEAL.

72 & 73, *Gracechurch Street, E.C.*,
June 13, 1898.

The Workmen's Compensation Act.

SIR,—I have read with very great interest your recent editorial notes on the cost, &c., of workmen's compensation, as also the letters of your various correspondents. But I find no mention of a profit-sharing scheme adopted by a first-class Non-Tariff Insurance Office, which, to my mind, is the fairest and safest yet placed before the gas world, and will therefore be of interest to your readers.

This office acknowledges that it is unable to determine the rate necessary for the risk, because its experience with the Employers' Liability Act of 1880 and joint policies is of little assistance in calculating rates under the new Act, for reasons mentioned both by Mr. Livesey and by your correspondents. Therefore, instead of accepting the business at rates which may prove totally inadequate to meet the losses and expenses (a course adopted by some Insurance Offices, who thereby may be endangering their very existence—a vital point to employers), it has arranged to accept Gas

Companies at a rate of 22s. 6d. per cent. of their wages; requiring only 15s. to be paid when the insurance is effected. If the 15s. should prove sufficient, the 7s. 6d. balance would not be called for. Or it is willing to "pool" a number of Gas Companies, treating them as one risk, and sharing with them the profits derived from their premiums; the same rates to be charged as above, with reductions in both cases ranging from 5 to 15 per cent. when the wages exceed certain specified totals. This Insurance Office also guarantees that its policies will cover the employers' entire liability under the Acts and at common law; and, even should the policies not be renewed, it will continue to indemnify employers against accidents occurring during the time the policies were in force.

There is another scheme adopted by an Insurance Office which should especially commend itself to those of us who expect to escape accidents—namely, to charge a rate of 7s. 6d. per cent. only, on condition, however, that employers cannot recover under the policy unless the losses exceed the Tariff Offices' rate of 25s. per cent. of the total wages; the Insurance Office being responsible for all losses and expenses beyond this limit.

I have heard it suggested that Gas Companies should undertake their own insurance. But this would add considerably to our work and responsibilities, and would cause much friction between employers and employed whenever we ventured to dispute a claim, just or unjust. Most of us are busy men, anxious to avoid extra labour and worry and unpleasant relations with our workpeople, egged on by those whose interest it is to stir up strife between us. Therefore I am in favour of employing experts in the settlement of claims; and, with this object, there appears to me to be every reason to insure with a really good office, which (at a cost of less than 0·1d. per 1000 cubic feet) will relieve employers not only of all risk but also of all worry and disputes.

321, *Dashwood House, E.C., June* 13, 1898. A. G. H.

The Temperature of Gas Measurement.

Sir,—The final report of the Institution of Gas Engineers *quoad* the temperature of gas measurement, is of great interest to me. It touches on a practical question; and we are divorced for a short period from the inevitable and ever-recurring reports and discussions over public gas testing and standards of light. I presume that what you have published in the "Journal" is simply a *résumé* of the results arrived at by the Sub-Committee. It has for a long time been an almost universal opinion that a comparison between the volume of gas made at the works and the aggregate registration at the consumers' meters was a mistake, owing to the possible fact that at the point of consumption the temperature might be lower than at the point of delivery. It has been left to the investigations of the Sub-Committee of the Institution of Gas Engineers to place that which was previously only suspected on a practical basis, and to give us definite facts.

The gist of the whole question appears to be this: For the future gas companies must not simply put down the difference between total make of gas and aggregate registration of consumers' meters as due to simple leakage, but that a large proportion must be attributed to differences of temperature. The matter affects the gas producer and the gas consumer. To the first, the question is plain; but to the gas consumer, the problem involved will not be so obvious. Will he appreciate that the differences in temperature act in his favour, and that, while he is paying for a nominal 1000 cubic feet of gas at the statutory price, he is really getting a larger volume of gas, for which he pays no extra?

There is only one fault which I can find as to the report of the Sub-Committee—viz., that they seem to have compared the *atmospheric* temperature of the gas sent out with the *temperature of the gas* at the consumers' meters. Would it not have been fairer to have taken a comparison based on *gas* temperatures at works and on delivery?

June 10, 1898. H. Leicester Greville.

Foundations.

Sir,—Referring to the remarks, towards the close of the article in the last number of the "Journal" on Mr. Walmisley's paper on the above subject, respecting the method of strengthening a weak subsoil by the insertion of sand or cement piles (which I presume is the form of foundation to which your question is directed), it may be a matter of interest to your readers to know that this system of piling has been rather extensively used on the Continent, but is hardly known in this country, though full details of the method of using sand in foundation works will be found in the fourth volume of the "Papers on Subjects connected with the Duties of the Corps of Royal Engineers," published in the year 1840. The method usually adopted is to pierce the subsoil to a depth of the soft ground, by forcing down a timber pile, which is withdrawn again after the required depth has been reached. The hole thus formed is then filled up with sand, cement concrete, or any other suitable material, which should, of course, be practically uncompressible. There are, however, several disadvantages attaching to this system which are unknown to the methods of piling generally adopted in England, especially in cases where the soft substratum is unable to resist any lateral pressure.

June 9, 1898. R. J. Milbourne.

The Wycombe Gas-Works Refuse Case.—The dispute which arose early in the year in consequence of the destruction of fish in the Wycombe district, owing to the discharge of refuse from the Gas Company's works, has been settled by the Company paying £219 damages and all the legal expenses.

Middleton Gas Supply.—At the meeting of the Middleton Town Council last Thursday, Alderman Walker presented the annual report of the Gas Committee. It stated that the total amount of gas sold for all purposes during the year was 91,387,000 cubic feet, as against 87,118,000 cubic feet in the previous year. The quantity of coal carbonized was 10,050 tons, as compared with 9169 tons. The expenditure was £7875, as against £7599; and the revenue amounting to £13,527, there was a balance profit of £5652. Of this £4745 was required for annuities, interest on loans, &c.; so that the balance of profit was only £907. This, he said, was satisfactory, considering that the works had been disturbed during the year by the building of new furnaces, which were now nearly completed.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: East Ham Improvement Bill, Plymouth and Stonehouse Gas Bill, Southampton Gas Bill, Southwark and Vauxhall Water Bill.

Bills read a second time and committed: Cardiff Corporation Bill, Southend Water Bill.

Bills reported: Brompton, &c., Water Bill, Bury Corporation Bill, Gas Orders Confirmation Bill (No. 1).

Bills read the third time and passed: Felixstowe and Walton Water Bill, Filey Water and Gas Bill, Ilkeston Corporation Bill, Newhaven and Seaford Water Bill, Newtown Water Bill, St. Anne's-on-the-Sea Gas Bill, Wath-upon-Dearne Urban District Council Bill, York United Gas Bill.

Petitions have been presented against the following Bills: Cranbrook District Water Bill, Heywood Corporation Water Bill, Rhymney and Aber Valleys Gas and Water Bill, Water Orders Confirmation Bill (in respect of the Broughton-in-Furness Order), Wigan Corporation Bill.

The Forres Water Bill, the Newcastle and Gateshead Water Bill, the Staines Reservoirs Joint Committee Bill, and the Water Orders Confirmation Bill have been referred to a Select Committee, consisting of Lord Heneage (Chairman), the Earl of Dartmouth, Lord Boston, Lord Granard, and Lord Monckton; to meet on Monday, the 20th inst.

HOUSE OF COMMONS.

The following progress has been made with Bills:—

Bill brought from the Lords, read the first time, and referred to the Examiners: Wath-upon-Dearne Urban District Council Bill.

Bills reported: Clacton-on-Sea Gas and Water Bill, Coventry Corporation Gas Bill, Maldon Water Bill.

Bills read the third time and passed: East Ham Improvement Bill, Plymouth and Stonehouse Gas Bill, Southampton Gas Bill, Southwark and Vauxhall Water Bill.

Petitions have been presented against the following Bills: Bacup Corporation Water Bill, Folkestone Water Bill, Kettering Water Bill, Tynemouth Corporation Water Bill.

The consideration of the Higham and Hundred of Hoo Water Bill and the Mid-Kent Water Bill, which was to have taken place last Friday, when it was the intention of the President of the Local Government Board (Mr. Chaplin) to move the insertion of the clauses for the protection of sources of water supply given in the "Journal" for the 31st ult., has been deferred till Thursday. Meanwhile, Mr. Sydney Buxton (Poplar) and Mr. Tomlinson (Preston) have put upon the paper a series of amendments which occupy rather more than a page of the "Votes."

Monday, June 6.

THE RATING OF RESERVOIRS.

Sir F. Dixon-Hartland asked the President of the Local Government Board whether he was aware that where the London Water Companies made new reservoirs by the permission of the House they claimed the right to have the land taken for such purpose rated at one-fourth of the ordinary assessment, on the ground that it was land covered by water, and therefore the parishes in which such reservoirs were situated were in reality deprived of three-quarters of their rates; and whether he would insist that a clause should in future be inserted in any other Bill, preserving the rights of the local authorities.

Mr. Chaplin: I am aware that land covered with water is, under the Public Health Act, 1875, liable to be assessed in the proportion of one-fourth only of the rateable value in the case of certain rates. If a reservoir of a water company is land covered with water within the meaning of the Act referred to, this partial exemption is the effect of the general law, and not of any special provision in the Acts of Water Companies. I am advised that this question is the subject of an appeal to the Court of Appeal at present; and I apprehend that it may come under the consideration of the Royal Commission on Local Taxation. Under these circumstances, I could not undertake to interpose with regard to the Bills of the Companies as suggested.

Sir F. Dixon-Hartland gave notice that when any Water Bill came before the House he would move to insert such a clause as indicated.

Thursday, June 9.

THE GASLIGHT AND COKE COMPANY BILL.

On the motion for the consideration of this Bill,

Mr. Pickersgill moved the insertion of the following clause: "(1) The conversions of stock by this Act authorized shall not take effect unless and until the Company shall have reduced the price of gas sold by them to 2s. 6d. per 1000 cubic feet. (2) It shall not be lawful for the Company to raise the price so reduced unless by order of the Board of Trade, and to the extent allowed by such order. (3) The Board of Trade shall not make any such order unless they are satisfied (after an inquiry at which the London County Council, the Corporation of the City of London, and any Vestry or District Board of Works within the Company's area of supply shall be entitled to be heard) that some exceptional circumstances have arisen making it reasonably necessary that the increase of price asked for by the Company shall be made. Any such order shall remain in force for such period only as may be specified in such order." He said that the Bill proposed to consolidate and convert the capital of The Gaslight and Coke Company. The interests affected were enormous, as the nominal amount of stock the Bill proposed to convert was very nearly twelve millions sterling. In 1876, an Act

was passed by which a parliamentary bargain was made between the Company and the consumers or the public; and the relation between the dividend payable and the price of gas chargeable was subject to a sliding-scale. By another section, it was stipulated that any stock afterwards issued should be sold at the best price obtainable; and the benefits of the premiums should inure to the consumers. The principle of the auction clauses really concluded the issue the House had now to decide. The object of the clauses was to strengthen and support the sliding-scale clause; and the joint effect of the two was to provide that the shareholders (from 1876 onwards) should not receive any additional advantage without some corresponding benefit to the consumers. The present Bill proposed to reopen this parliamentary bargain, and to reopen it solely in the interest of the Company. The Company desired to replace the nominal value of their stock by a face-value which would more closely approach to its market value. When the South Metropolitan Bill was before the House, the Chairman of the Company estimated the enhancement of the stock by conversion would be £90,000; the County Council estimated the enhancement at £250,000; whereas it was, in fact, according to the Stock Exchange value, £900,000. He did not say that the enhancement was solely due to the conversion; but he claimed that the conversion was the cause to a very considerable extent of the enormous enhancement. One effect of the present Bill would be that, while the Company were apparently paying 5 per cent., they would in reality be paying 12¾ per cent. on their ordinary stock. In the second place, if at any time it was desired to purchase the property of the Company, the position of the public would be prejudiced if the Bill became law; because the Stock Exchange value of the shares would be likely to influence the mind of the Arbitrator. South of the Thames, the price of gas was 2s. 3d. per 1000 cubic feet. In the area of The Gaslight and Coke Company the price was 3s., having just been raised from 2s. 10d. The Company were behaving with particular harshness to the poorest class of consumers, who were supplied by the penny-in-the-slot arrangement. These people had paid in the aggregate 3s. 4d. per 1000 cubic feet; but henceforth they were to pay 1d. for 22 cubic feet, or nearly 4s. per 1000. No doubt, by raising the price of gas 2d. per 1000 feet, there would have to be a reduction of the dividend of the Company by ½ per cent.; but their object was to prevent a still larger fall in the dividend. The reduction which would be caused by the raising of the price would amount to £30,000; whereas the raising of the price would take £200,000 out of the pockets of the consumers. In moving the clause, he was simply giving effect to the views of all the representative Authorities of the Metropolis, endorsed by large public meetings of the citizens. He pointed out that he was supported both by the Corporation of the City of London and the London County Council, who, for once, were making common-cause with each other; and this, in itself, was significant.

Mr. Harwood seconded the amendment, contending that there should be no manipulation of shares tending to disguise the true character of a monopoly. Wherever Parliament had granted a monopoly, it should retain in its own hands power to value it from time to time.

Mr. Johnson-Ferguson, as Chairman of the Committee of the House who considered the Bill, pointed out that there was nothing in the Bill which would enable the Company to levy a penny of extra charge on the consumers or to pay to the shareholders a penny of extra dividend. The dividend would be precisely what it was at the present time; the difference being that the ordinary stock, instead of being £100 of 10 per cent. stock, would be £250 of 4 per cent. stock. There was nothing new in this; and leave to split their stocks had been granted to the Bristol, Oxford, Crystal Palace, Plymouth and Stonehouse, Scarborough, Cheltenham, Ilfracombe, and South Metropolitan Gas Companies. When it was evident that the Committee would pass the preamble of the Bill, the opponents asked them to authorize an alteration in the standard price of the Company. In 1876, after a long and exhaustive inquiry before a Committee of the House, the standard price for the three Metropolitan Gas Companies was fixed as follows: Gaslight and Coke Company, 3s. 9d.; South Metropolitan, 3s. 6d.; Commercial, 3s. 9d. He asked Counsel for the opponents if he could point to an instance in which, when a standard price for a gas company had been fixed by Parliament, this had been altered. Counsel could not produce an instance; and he himself had since been informed that, though numerous applications had been made to Parliament to alter the standard price, in every instance they had been rejected. He pointed out that there was nothing in the Bill which would enable the Company to levy 1d. extra on the consumers, or to pay to the shareholders an extra penny in dividend. The only valid argument against the Bill was that the public might be deceived as to the real amount of capital involved; but the Committee had taken steps to meet the difficulty by requesting the Board of Trade to see that the Company in their balance-sheets showed how much of their stock was for capital expenditure, and how much was due to division under the Bill. He appealed to the House to resist this attempt, in a Bill dealing simply with the question of splitting stocks, to upset the deliberate decision of Parliament arrived at after a very long and exhaustive inquiry.

Mr. Cohen did not at all object to the readjustment of the stock of the Company, and said he would not oppose the Bill at all if it were not for the fact that this was the only opportunity the House had of dealing with the crying injustice from which they were suffering in the North of London, in consequence of the wholly unjustifiable price they were paying for their gas. If, however, they could have an assurance from the President of the Board of Trade that there should be an inquiry which would give them some prospect of relief from the injustice, he should advise the withdrawal of the amendment. In the absence of any such assurance, he should vote for the amendment if it were taken to a division.

Sir J. Pease urged the House not to review the decisions of Committees on Private Bills. If it did, it seemed to him that the House would involve itself in the discussion of questions the merits of which could not be wholly or even properly before it. If they once began to review these decisions, they destroyed the independence of the Committees and opened the door to the system of "lobbying" which was taking place on this very Bill. Every large railway company had in recent years been before the House with a request for consolidation of its stock; but the House had never made the lowering of fares a condition of granting the request. It would be most illogical to do so; and equally illogical was it to say that because the present Bill would give the Company an advantage in the market value of their stock—placing it at such a figure that it would be within the power of the working classes to invest in it—the Bill should not pass unless the Company lowered the price of gas to consumers. He was opposed to such revisions on principle; and the present case furnished no ground for exception.

Mr. James Stuart said he gathered from the speech of the Chairman that the Committee who considered the Bill had not realized the point now raised; and the hon. gentleman who had just spoken had failed to seize the real issue raised by the amendment. In 1876, when the sliding-scale was introduced, the Company and the public were made partners in the business. The initial price of gas being fixed at 3s. 9d., for every penny reduction the Company were to divide an additional 5s. per cent. A similar arrangement existed in respect to the South Metropolitan Gas Company; the initial price there being 3s. 6d., because there was not the over capitalization that there was in the case of The Gaslight and Coke Company. Twenty years' experience had shown admirable management on the part of the Southern Company, whereby the public had largely benefited; while on the part of The Gaslight and Coke Company there had been mismanagement, with the result that, allowing for the initial difference of 3d., the consumers had to pay 6d. per 1000 cubic feet for gas more than was charged on the south of the Thames. It had been a loss of half a million of money to the public. In 1892, the London County Council, acting on behalf of innumerable Vestries and Local Boards, asked the Board of Trade for an investigation; and they were told that the proper opportunity for raising the question was when the Company came before Parliament with a Bill. All that was now asked was that the House, acting on behalf of the public, should say to the Company: "You are joint partners with the public; you have an example of what should be done; do as well as your neighbour, and we will allow this advantage." If any member would say that the Company would accept the principle of the proposal, and arrange a clause in the passage of the Bill through the House of Lords, he would advise the withdrawal of the present motion.

Mr. Moon remarked that what affected the minds of his constituents was the difference in the price of gas as between the South Metropolitan and The Gaslight and Coke Companies. He fully accepted the views of the hon. baronet the member for Darlington, and should willingly vote for the new clause if the President of the Board of Trade absolutely declined to grant an inquiry, as had been suggested more than once.

Mr. Ritchie observed that the very point to which the amendment was directed had come before the Committee; and the House of Commons would be taking upon itself the functions of the Committee if it attempted to go into the details of the management of the Company with a view to seeing whether the price of gas ought to be reduced. That was a duty it would be impossible for the House adequately to fulfil. Every objection against the Bill had been urged before the Committee; and they had decided against the proposal contained in the amendment. Yet the hon. member asked the House to adopt a course which the Committee, on the evidence before them, had refused to follow. He did not think that this would be an advisable proceeding for the House to take. He was not in a position to speak either for or against the way in which the Company was managed. He regretted as much as anyone the fact that the Company had considered it necessary to raise the price of gas considerably beyond what it was in other parts of London. Although this was his opinion, he could not support the proposition of the hon. member without adequate evidence that the price of gas ought to be reduced. He had, in answer to questions put by the hon. member for Bethnal Green, stated that if he would move for a Committee to inquire into the subject, he (Mr. Ritchie) would, in the interest of all concerned, carefully consider such a motion, and see what might be done in the direction to which he pointed. Beyond that, it was impossible for him to go.

Mr. John Burns contended that the House had a perfect right, and, indeed, it was its function, to review the decisions of its Committees. If Moderate or Conservative members desired to know why Conservatism was losing ground in London, especially in matters affecting local life, the reason was to be found in the impression which prevailed among supporters of the Moderate and Conservative parties that the House of Commons was too anxious to suit the convenience of monopolies; members of those parties rarely opposing them on behalf of the public. He trusted the amendment would be adopted in the interest of five millions of people who had a right to appeal to the House of Commons against the profit-mongering of a gas monopoly which now took 10 and 12 per cent. dividends—a rate of profit which ought to be limited in the interests and for the convenience of the people of London.

Sir J. B. Maple said they had heard such speeches as this before, and were likely to hear them again. But the practical question which the House was asked to decide was whether they should prevent this conversion of stock taking place until gas was supplied at 2s. 6d. per 1000 cubic feet. He contended that the public would gain rather than lose by the proposed conversion of stock. The division would be effected in such a way that people with smaller incomes would be able to invest in the Company's stock. When hon. members stated that gas was supplied at a cheaper rate in other parts of London, they omitted altogether to take into consideration the circumstances which caused it to be dearer in North London. The Gaslight and Coke Company managed their affairs as well as any other Gas Company in London, and were as well able to look after the interests of their customers and the public as some hon. members on the opposition side of the House.

The House divided—

For the amendment	109
Against.	214
Majority against	—105

The amendment was, therefore, negatived.

A Disappearing Kent River.—Much interest is being taken in the St. Mary Cray and Darenth districts of Kent in a local discussion of the causes which have led to the gradual drying up during the last ten years of the River Cray. This was once a clear running stream; but the springs which supplied it have been falling gradually lower, and in some places the course of the river is already dry. Committees have been appointed by the Bromley and St. Mary Cray Councils to investigate the matter; and it is being urged that an official inquiry should be held to discover the cause or causes of what has already become a great inconvenience, and may, it is feared, result in a serious nuisance and grave danger to the public health.

HOUSE OF COMMONS COMMITTEE.

(*Before Colonel* GUNTER, *Chairman, Sir* L. LYELL, *Mr.* SEELY, *and Mr.* PHILIPPS.)

The above Committee, to whom were referred the Bills in Group E—comprising the Brompton, &c., Water Bill, the Southend Water Bill, the Haslemere District Water and Gas Bill, the Wey Valley Water Bill, the Cranbrook District Water Bill, the Higham and Hundred of Hoo Water Bill, the Mid-Kent Water Bill, and the Clacton-on-Sea Gas and Water Bill— commenced their sittings on Wednesday, the 27th of April; taking first the Bill at the head of the list.

BROMPTON, CHATHAM, GILLINGHAM, AND ROCHESTER WATER BILL.

According to the opening statement of Mr. Pember, Q.C., who (with Mr. Worsley Taylor, Q.C., Mr. A. Frere, and Mr. G. V. Davis) was engaged on behalf of the Company, the issues in this Bill were very plain, simple, and direct, though they were opposed by the Corporation of Chatham, the District Council of Gillingham, and Mr. R. D. Batchelor, a landowner. There had lately been a great increase in the consumption of water in the Company's district, arising from the increase of population; and this increase was likely to grow, seeing that main drainage schemes for Chatham and Rochester were imminent, besides which there was a large Government barracks on the eve of completion, which would all require considerable quantities of water. The works proposed comprised the improvement of the present pumping-station at Luton, and the construction of a main from that station to the proposed new reservoir in the parish of St. Margaret Extra (which was to be included in the area of supply), where it would be at such a height as to enable the supply of the district to be made by gravitation. The new capital proposed was £60,000, to be raised by the issue of shares; the limit of dividend being 7 per cent. on the portion raised as ordinary shares, and 6 per cent. on the preference shares. These shares would be issued in the ordinary way, according to the model clauses, by auction. Probably therefore the £100 preference shares would be raised at nearly £200; seeing that the Company had a clean record, were in a flourishing condition, and were paying their full statutory dividend of 10 per cent. There was also power to borrow £15,000 by debenture stock, by auction, which would probably be done at 3 per cent. The present average daily supply was about 1,286,000 gallons; and the maximum summer day's supply, 1,608,000 gallons. The increased supply was calculated to be sufficient for about the next twenty years. The water was derived from the great chalk reservoir which underlays Kent, and was practically the same as that supplied by the Kent Company to London. The water contained about 16° of hardness, which, by boiling, could be reduced to 3°. Mr. Batchelor, who had petitioned against the Bill, owned a considerable area of land, of which 19 acres were to be taken. On his land he carried on the trade, among other things, of a brickmaker; and for this purpose, it was necessary that he should have a large supply of water. He had hitherto obtained this by sinking wells; and though he said the present supply was inadequate to his requirements, it was of the utmost importance that the quantity should not be diminished. The Company, however, took no water from him; and if they did, they would be prepared to supply him with all he wanted at cost price. The Company wished to take so much of his land in order to preserve the purity of the water. After having acquired it, they would be willing to lease it to him (as had been done at Birmingham and Manchester), so that he could still continue his brickmaking there, but under such conditions as to prevent pollution. The Corporation of Chatham and the Gillingham Urban District Council, in their petition, objected to the proposed additional share and loan capital, on the ground that the burden must ultimately fall on the consumers of water in the Company's district; and the petitioners had no confidence that the money to be raised would be usefully or economically expended. In reply to this, Counsel pointed to the past history of the Company as showing that there was no ground for the allegation. Moreover, the operation of the model clauses was sufficient guarantee for the public. Then the petition alleged: "It is now well recognized that the water supply of a town should be in the hands of the local authority, whose first consideration is the purity and sufficiency of the supply, and not the profits to be derived from the selling of water." In regard to this, Counsel asserted that whoever was the authority, in this case they could get no water except that which the Company proposed to secure. The petitioners also stated that they were two of the three urban district authorities within the Company's area, and that they were prepared, either jointly or in conjunction with the Corporation of Rochester, to purchase the undertaking on fair and reasonable terms. Counsel, however, contended that, until they could show that Rochester would join in the purchase, and until there was greater unanimity among the petitioners themselves, no Bill for the purchase would have a chance of passing. The petition also contained allegations that the proposed new capital was excessive, and should be reduced; that the charges were high; that provision should be made for softening the water; that the clause relating to the supply of meters was objectionable, particularly as to the powers sought to prescribe the form of meter to be used by the consumers; and that clause 45, which provided that the Company should not be compelled to supply with water any dwelling-house in which any trade was carried on, was most objectionable, both in regard to convenience and health, and that if such provision was inserted the price at which water was to be supplied by meter for trade purposes should be specified in the Bill.

The Counsel engaged on behalf of the petitioners were Mr. Erskine Pollock, Q.C.; Mr. Morton Smith for Mr. R. D. Batchelor; and Mr. Balfour Browne, Q.C., Mr. Morton Smith, and Mr. Honoratius Lloyd for the Chatham Corporation and Gillingham Urban District Council.

Evidence in support of the Bill was given by Mr. George Catt, the Secretary of the Company, who stated that from the commencement the Directors adopted a more graduated scale of charges than that in their schedule; the result of which was to reduce them by about 30 per cent. One proposal of the present Bill was to make the basis of charge rateable value, the effect of which would be to still further reduce the charges. The population of the district was now about 86,000, and the number of houses supplied 17,152; there being an increase in the latter of about 500 or 600 a year. The Company furnished the War and Admiralty Departments at Chatham, under contract at low prices, with about 85 million gallons of water per annum. The Company were at present very heavily drawn upon; and occasionally they had to run the pumps continuously, which was somewhat dangerous. The Admiralty, when they were mobilizing, often called upon the Company for a large quantity of water; and the Directors made a point of supplying them, which often involved a very heavy strain. The present reservoir capacity was about 3½ million gallons. It was important to take the area proposed of Mr. Batchelor's land, in order to secure that the water should be pure. The Company supplied many houses which were partly used as dwelling-houses and partly as business premises; and it was proposed to give power to the Company to fix a test-meter in cases where there was suspicion that the quantity used for business purposes was abnormal. For houses where there was both trade and domestic consumption, the charge was the same as for those using the water for domestic purposes only; but it was proposed to make an extra charge where the trade consumption was large. There had been no complaint against the purity or sufficiency of the water supplied by the Company; and there was great apathy on the part of the people locally with regard to transferring the undertaking to the Local Authority.

In cross-examination by Mr. Balfour Browne, witness said the Company had paid their full dividends, and now had a reserve fund of £6000. They therefore had reduced their charges by 12½ per cent. By basing their charges on rateable value, as proposed in the Bill, this reduction of 12½ per cent. would be removed; but the payments of the consumers would be about the same. "Annual value or rent"—the Company's present basis of charge—was interpreted in the Dobbs case as meaning net annual value; and therefore if the Company had been charging on the rack-rent, and not on rateable value, they had been doing what was wrong—that was if the Dobbs decision was of universal application.

Further evidence in support of the Bill was given by Mr. W. J. M'Lellan, Mayor of Rochester; Mr. Apsley Kenwette, Town Clerk of Rochester; Mr. Willis, ex-Mayor of Rochester; Mr. William Tozer, of Gillingham; and Mr. William Randall, of Chatham. Their testimony was directed to showing that purchase of the Company's undertaking was not desired locally; that if it were effected a burden would be cast upon the rates; and, further, that satisfaction was felt with the supply both as to quality and quantity. Mr. M'Lellan thought the three Local Authorities, if they had the undertaking, would not be able to work it. He agreed that the Rochester Corporation had acquired the Strood Water Company; but he declined to answer a question as to whether there was any intention of carrying out a resolution passed a few years ago, by which the three Local Authorities were to unite in promoting a Bill for the purchase of the Brompton Company.

Mr. J. Taylor, M.Inst.C.E., F.C.S. (of Messrs. Taylor, Sons, and Santo Crimp), the Engineer to the Chatham Water Company, gave a description of the works; the yield of the wells being just over 2,000,000 gallons daily, and the pumping capacity 1,800,000 gallons per 24 hours. He calculated, on the basis of the present increase, that the supplies which the Company would have to deal with in 1917 would be 27,850. The quantity used per supply daily at present was 76 gallons; but he estimated that the drainage schemes contemplated would involve a further consumption of 3 gallons per head, or 15 gallons per supply—assuming an average of five persons per supply. This would increase the 76 gallons to 91. He therefore estimated the daily average supply in 1907 would be 2,079,000 gallons; and in 1917, 2,534,000 gallons. The maximum demand for any one week was 25 per cent. above the average; so that the Company must provide for a demand of 2,600,000 gallons daily in 1907, and 3,167,000 gallons daily in 1917. To meet this, it was proposed to drive further headings, and erect fresh pumping machinery, capable of raising 3 million gallons per 24 hours. The old pumps would be left to act as duplicates, so far as they would do so. Owing to the elevation of the existing service reservoir, 5746 acres of the Company's district (a considerable portion) could only be imperfectly supplied. It was therefore contemplated to construct another reservoir at Woolman's Wood, 466 feet above Ordnance datum, or 160 feet above the level of the existing reservoir, which would enable the whole district to be supplied by gravitation. To connect the pumping-station with the reservoir, a new 12-inch main, 3 miles in length, would be made. Some 26 acres of land in all, adjacent to the pumping-station, was proposed to be acquired, in order to preserve the purity of the water; the tendency of buildings in Chatham being to extend towards the pumping-station. The new capital sought was allocated approximately thus: Extension of underground headings, £5000; new engine, £13,800; engine-house and boiler-house, £4000; boilers, £1200; new reservoir, £5000; new main, £4560; and extensions (pipes, &c.) to meet the growth of the district for about fifteen years, £12,000. This left about £14,000 for the acquisition of land and to meet the expenses of the present Act. The £15,000 to be borrowed would be devoted to enlarging and altering the present engines, duplicating some mains, and laying a main from the new reservoir to Borstal. The Company would have no objection to leasing Mr. Batchelor's land back to him after purchase, on such conditions as would not interfere with the brick making, but would prevent any contamination of the water there. Since Mr. Batchelor received notice that his land was scheduled, he had commenced making the land fit for brick making, and also began to sink a well. The water consumed per head daily in the Company's area for domestic purposes was very low—14 or 15 gallons. Usually in a water-closeted district the consumption was from 20 to 25 gallons.

Further evidence corroborative of the Company's case was furnished by Mr. W. Hunter, M.Inst.C.E., Engineering Director of the Grand Junction Water-Works Company; and Professor James Dewar, President of the Chemical Society, &c. Professor Dewar stated that the water was exceedingly pure chalk water, containing but an infinitesimal amount of organic impurity. He strongly supported the taking of Mr. Batchelor's land; saying that if the brick-earth were removed—that earth itself being of great use in filtering water passing through it—and there were any fissures in the under soil, pollution might easily follow.

Mr. Batchelor, in support of his petition, said that he was a consulting artesian well engineer, a contractor, a farmer, and a large manufacturer of bricks. His brick-works were situated on land adjoining that

which the Company wish to acquire; and owing to the excellent quality of his bricks, he found it matter of necessity to extend the works. The only place where the extension could take place was on the land in question; it being level (an absolute necessity), the aspect being right, and there being the necessary brick-earth and chalk. He simply wished to be left alone, and would be pleased to give the Company a cheque to go away. Moreover, there were a number of dwellings—a public-house and cottages—near the water-works, which the Company were not seeking to acquire, and from which there was more danger of contamination than would arise from any cottages which he might erect. The proposal to take the land as a safeguard was therefore incomplete.

Mr. W. L. Grant, a surveyor, of Sittingbourne, was being examined in favour of Mr. Batchelor, when the Chairman interposed with an intimation that the Committee had come to the conclusion that, whether the undertaking remained in possession of the Company or was purchased by the Local Authorities, the land of Mr. Batchelor which had been scheduled should go with the water-works.

The case for the Corporation of Chatham and the Gillingham Urban District Council was then proceeded with. The evidence of Mr. G. H. De la Cour, the Mayor of Chatham, and Mr. C. T. Smith, a Chatham Alderman, showed that feeling in the town was strongly in favour of the purchase of the undertaking; the Corporation being unanimous on the point. Calculations had been made, as a result of which it was believed that pecuniarily the step would be desirable. In 1893, Chatham and Rochester each promoted a Bill for the purchase; but they were withdrawn upon resolutions being passed by the two Corporations and the Gillingham Local Authority to promote a Bill the next session. Since these Bills were promoted, the Company's charges had been reduced by 12½ per cent. No Bill had since been introduced; but recently Chatham and Gillingham had agreed to come next year, with or without Rochester, for a Purchase Bill. One complaint urged against the Company was that the water was unduly hard; and that the Company ought, but had hitherto refused, to soften it. In view of the proposed purchase, objection was taken to a large proportion of the expenditure contemplated, inasmuch as it would mean a considerable enhancement of the price to be paid. There was no necessity for this expenditure to be immediately incurred—at all events, Chatham would take whatever risk was involved in postponing the commencement of the new works for a year. The reason no action towards purchase had been taken since 1893, was that Chatham being a new Corporation their hands had been full; and even now, but for the present Bill, they would not be moving actively in the matter. At the time of the Local Authorities' Bill, it was estimated that it would cost £1200 a year, exclusive of the outlay on plant, to efficiently soften the water.

On the following day, further evidence in support of the Local Authorities' petition was given by Mr. F. Wingent, of Rochester, Mr. G. H. Hill, M.Inst.C.E., and Mr. R. H. Cock, Chairman of the Gillingham Urban District Council. In Mr. Hill's opinion, this was a very favourable time for purchase, seeing that the Company had practically reached the end of their resources, and wished to extend their works in all directions. The plan proposed by the Company for procuring a further supply was a proper and reasonable one. While Mr. Cock was being examined, the Chairman said the Committee would take it for granted that there would be a Bill for purchase next year; but they did not consider the question of purchase was practically before the Committee. They thought the evidence on the petition should be directed to showing that the works were unnecessary or the capital excessive.

Mr. Balfour Browne said, in these circumstances, he would not call more evidence, though he reminded the Committee that the matter of purchase was distinctly raised in the petition. It would be going beyond the precedent of Parliament to ask the Committee to insert in the present Bill a compulsory purchase clause. Nothing like the expenditure of £60,000 was required at once; Mr. Hunter having put the cost of what was immediately needed at £20,000. Therefore, as the Local Authorities intended to promote a Purchase Bill next year, he asked the Committee to insert a suspense clause, saying that until the time for giving notice, officially, for the promotion of such a measure had expired, the Company should not spend any money that was not necessary for the continued supply of the district; and if such notice were given, only ordinary expenditure should be undertaken, and if it were capital expenditure the consent of the Local Authorities should be required. This had been done repeatedly in other cases; the object being to secure that nothing should happen to prejudice the water consumers of the district.

Some conversation then passed between the Committee and Mr. Pember relative to various points raised by Mr. Balfour Browne in his speech. Ultimately the Committee found the preamble of the Bill proved; intimating that the £60,000 additional capital meant £60,000 cash, and not £60,000 shares. The clauses were then adjusted, and the Bill passed the Committee.

At the close of the proceedings on the Brompton, &c., Water Bill on April 29, the Committee (the constitution of which had been changed by the substitution of Captain Sinclair for Sir L. Lyell) took up the consideration of the

SOUTHEND WATER BILL.

By this Bill, it was proposed to secure a further supply of water with which to meet the continued growth in the population of Southend, by taking powers to sink wells of great depth in the parishes of Bowers, Gifford, Vange, and Basildon, situated to the west of Southend.

The Company was constituted under the Companies Clauses Act of 1862. The population of the district had grown considerably; and from time to time fresh powers as to the inclusion of districts and the expenditure of capital on fresh pumping-stations were obtained. Some of these additional works had not yet been completed. The capital at present authorized amounted to £200,000, including borrowing powers, but only £137,000 had been expended. The whole of the balance, however, was absolutely pledged in carrying out the already authorized works at Thundersley, Burches, and Bricketts. The Bill proposed, in view of the fact that the Company were going to various districts outside their area for the further supply, to include those districts; but negotiations, Mr. Balfour Browne, who opened the case for the Company, said, had taken place with the Local Authorities, who seemed to wish to supply themselves. The Company had no particular desire to include these districts in the limits of supply; and, in order to meet the views of the Local Authorities, they were prepared to abandon their proposal, and to give the Authorities a prior right to the water pumped before taking any for the supply of Southend—leaving the distribution of the water in the districts in the hands of the Local Authorities. Though there was a petition in reference to this matter, it was likely that an agreement would be arrived at. The water in question was in a clay deposit in the chalk. The dividend of the Company had been very small indeed. In 1879, it was only 4 per cent.; from 1880 to 1889, 4½ per cent.; from 1890 to 1896, 5 per cent.; and in 1897, 5½ per cent. One peculiarity of the case was that the town, being a watering-place, the population, which was now estimated at 23,500, was on Bank Holidays often increased to 60,000 or 100,000; and for the wants of the influx of these visitors, water had to be provided. The principal opponents of the Bill were the Corporation of Southend, who, contrary to all precedent, wished the Committee to insert a purchase clause. Such a step would, however, be most unfair at the present juncture in the Company's affairs. Though hitherto the Company had been paying small dividends, there was every prospect that they were about to turn the corner; so that the Corporation would buy on the basis of low dividends, and reap the advantage of the increased profit. The new capital sought to be authorized was £176,000 at 5 per cent., with the usual power to borrow a fourth more, all of which would be raised under the auction clauses. The estimate for the whole of the new works was £210,000; so that the whole of the new capital would be required. As regarded the quality of the water, there was no question; it being taken from the deep wells in the chalk, and thoroughly filtered. It had been given the best character by the Medical Officers of the district. The petition of the Southend Corporation alleged that the principle that the water supply of a town should be in the hands of the local authority was well recognized and was constantly acted upon by Parliament; and it was especially necessary in the case of a town like Southend, which depended for prosperity upon its reputation as a health resort, that every step should be taken to perfect the water supply. It was quite true, Counsel said, that Parliament had in a great many cases entrusted local authorities with the duty of supplying their districts with water. But in hundreds of places companies existed simply because the authorities there had failed to do their duty; for it was the duty of every local authority to supply water. It was an exceedingly mean position for an authority to take up—not to enter on the undertaking when there was a doubt as to the profit, and then when the profit was sure to seek to come in. It would be a monstrous thing if local enterprise were to be discouraged in this way. As to perfecting the water supply, it was already perfect, as was shown by the report of the Medical Officer, who recently stated: "I have again to emphasize the excellent character of the water, and the admirable management of the water-works." The petition went on to submit that, on these grounds, the Company should be required to sell their undertaking to the Corporation, who were quite willing to pay a fair value for it. One ground urged in favour of the transfer was that all loans raised by local authorities had to be repaid within a period not exceeding sixty years, at the end of which time the concern would be the unencumbered property of the ratepayers. This was quite true; but he failed to see why the ratepayers of to-day were to purchase a concern which the ratepayers of sixty years hence were to possess. Then the Corporation held that the proposed capital was excessive; but this was of no interest to them, except in the unimportant respect that it might keep the Company away from Parliament too long. The next contention was that the Company should be prohibited from paying in any year larger dividends than the prescribed maximum, with a view to making up deficiencies of former years. This seemed to be most objectionable, for it amounted to confiscation. In the interests of the health of the borough, the petitioners sought the right to inspect the Company's works, and to take samples of, and analyze the water obtained; and in cases where the Company cut off a water supply, they wished it to be provided that notice should be given to the Corporation. Both these powers were unnecessary. The Company had to supply good, pure, and wholesome water; and it was a sample taken from any one of the thousands of taps—and not from the works—which would show whether the water was good. There was really nothing in the petition except purchase; and that there was no earnestness in this suggestion, was shown by the fact that the Corporation, until the present Bill was introduced, had never attempted to negotiate. There was another petition, which came from Mr. R. L. Curtis, the owner of the Vange Hall Estate of about 350 acres, containing valuable beds of brick-earth which had been worked for the last fifteen years. He had driven a well 800 feet deep, with which to procure water for his business and for the cottages on the estate; and he submitted that if the Company were to drive deep wells, they would drain his well; and further that, if the works were authorized, the Company should be prohibited from driving adits under any other land than that which they had purchased. With regard to the latter point, Counsel said the Company had no right to drive adits without paying; and as to the former, it being established by law that there was no property in underground water, the Company were quite entitled to do as they proposed—even if they did drain the well.

The Counsel engaged were: Mr. Balfour Browne, Q.C., Mr. Freeman, Q.C., and Mr. Honoratius Lloyd, for the promoters; Mr. Pope, Q.C., Mr. Worsley Taylor, Q.C., and Mr. Duke, for the Southend Corporation; Mr. Forbes Lankester, for Mr. R. L. Curtis; and Mr. Macmorran, Q.C., for the Billericay Rural District Council. An appearance was also entered on behalf of owners in the parishes of Vange, Pitsea, Bowers, Gifford, and Basildon.

The witnesses called on behalf of the promoters included Mr. John Ayris, the Manager of the Company, who referred to the enormous increase which had taken place in the population of the town during the last three or four years, and said that there were no fewer than 999 baths in use there. He expressed the opinion that it was imperative for the Company to at once arrange for obtaining a new supply, as the average quantity of water used per head per day had increased from 18·18 gallons in 1894, to 21·50 gallons in 1897. Unless they did their duty at once, by preparing to get an additional supply, they would have a water famine to deal with. He had therefore advised the Company that they must at once incur the further expense proposed under the Bill. The Company paid no dividend up to 1875. The back-dividends due to shareholders amounted to some £24,000; and he thought it would be very unfair to deprive them of this, especially in view of the fact that people had bought shares relying

on the right to back-dividends. The Bill would rather more than double the existing borrowing powers.

Mr. Charles Hawksley, M.Inst.C.E., stated that, with the assistance of the previous witness, he had selected the sites of the four additional pumping-stations and service reservoirs proposed to be constructed; and he regarded it as absolutely essential, in view of the extraordinary growth of the population, that the Company should have power to supply more water. Otherwise he thought they would find themselves in the position in which the East London Water Company were two years ago. Parliament, at the instigation of the London County Council, declined to give the East London Company the powers they sought; and the result was that they found themselves unable to supply the quantity of water required. The Southend Company were, in his opinion, asking for less than was desirable; and he himself had certainly been in favour of the acquisition of larger powers. Mr. E. M. Eaton, Assoc.M.Inst.C.E., supported Mr. Hawksley's evidence.

Counsel for the Corporation of Southend called Mr. J. Francis, the Chairman of the Law and Parliamentary Committee of the Council, as their first witness. Like the witnesses for the promoters, he spoke of the enormous increase in the population of the borough during the past few years; and he pointed out that the rateable value of Southend had increased from £69,000 in 1891 to £131,451 at the present time. He described the view of the Corporation as being that, if they were ever to acquire control of the water supply of Southend, this was the time for taking steps to do so. At a meeting in February, the Council decided to apply at the earliest opportunity for the purchase of the undertaking, and resolved that in the meantime nothing should be done to prejudice their position in this respect. A meeting of ratepayers was held on March 7; and a resolution endorsing the decision of the Council was carried. The question had been under consideration in Southend for some years past; and the view generally taken was that, at the first opportunity, the Corporation ought to acquire the water-works. In the opinion of the Corporation, the fullest compensation ought to be given to the shareholders for what they had done and the risks they had run; but it was believed that if this Bill passed without any limitation, the possibility of acquiring the undertaking would be practically postponed for years.

Mr. J. H. Burrows, Mayor of Southend, stated that the Corporation had in recent years spent a very large sum in increasing the efficiency of the sanitary arrangements of the town, and in improving the place generally. He added that ever since he had known Southend—some 16 or 17 years—there had been a strong feeling among the people that the water-works ought to be under the control of the Local Authorities. He himself shared this feeling. In reply to questions put by the Chairman, witness said he had no complaints to make as to the quality of the water supplied by the Company; while as to the quantity, the only complaint was that the supply was short two or three seasons ago. He believed that, if the undertaking were in the hands of the Corporation, they could so work it that water could be sold to Southend consumers at a less price than that now charged, which would be a decided advantage from a sanitary point of view. He had not gone into the figures himself; but he was advised that the price could be reduced, and of course the Corporation could borrow money at a much lower rate than the Company. Mr. A. Fidler, the Borough Surveyor of Southend, and Mr. Hill also gave evidence for the Corporation; and Mr. Duke addressed the Committee on their behalf.

The Committee then adjourned till the following Tuesday, when evidence in support of Mr. Curtis's petition was given by the petitioner himself, and by Mr. Alfred Le Grand, senior partner in the firm of Le Grand and Sutcliffe, hydraulic engineers. Mr. Curtis explained that he had sunk a well on his property at Vange, at a cost of about £2000, from which he obtained water for use in his business as a brick maker, and for consumption by the cottages on his estate. The Company proposed to sink two wells, each about three quarters of a mile away, which he was advised would take the water from his well. The effect would be to render his expenditure useless; and not only would the Company take his water, but they proposed to make him pay for the water which, in that case, he would have to obtain from them. Mr. Le Grand said his firm sunk the well in question, the yield of which was about 1000 gallons an hour, pumping continuously. Most certainly sinking the two proposed wells would injure Mr. Curtis's supply.

Mr. Forbes Lankester, in addressing the Committee, said there was a difference between an individual and a company buying land and sinking a well; for whereas a person could do so without consulting anyone, a company must take parliamentary powers. Now that the Company, in the present case, were seeking this power, he urged the Committee to give his client protection by inserting a clause to the effect that if, in the opinion of an arbitrator, the operations of the Company had the effect of depriving the well of water, they should give him, free of charge, a compensating quantity to enable him to carry on his business and to supply his cottages. The clause that had been agreed with the Billericay Council was not compulsory; so that if the Authority did not ask for a supply, Mr. Curtis would be absolutely without water, and would have to discontinue his business. It was true, he admitted, that the Local Authority were bound to supply water; but unfortunately they did not always carry out their duties, and there was no assurance that they would do so in the present instance.

Mr. Balfour Browne, in replying on the whole case, said Mr. Curtis's claim amounted to a desire for an acknowledgment of a right which did not belong to him; for though Mr. Curtis pumped the water, it was not his property but that of anybody who happened to get it. Counsel was proceeding to deal with the opposition of the Southend Corporation, when the Chairman said the Committee found the preamble proved.

Some discussion then took place as to whether a clause should be inserted under which the Company would have to give notice to the Southend Corporation of the cutting off of any supply of water. The matter, however, was decided against the Corporation.

Incandescent Gas-Lighting at Falmouth.—On the recommendation of the Lighting Committee, the Falmouth Corporation have decided to gradually extend the system of incandescent gas-lighting throughout the borough. An experiment has yielded satisfactory results; but the Committee, being of opinion that success largely depends upon the skilful care of the lamps, recommend that the Gas Company be invited to undertake the work of cleaning, lighting, and extinguishing.

HOUSE OF COMMONS COMMITTEE.

(*Before Sir* W. Houldsworth, *Chairman, Mr.* Burt, *Mr.* Banbury, *and Mr.* Stevenson.)

MATLOCK URBAN DISTRICT COUNCIL BILL.

By this Bill, which came before the above-named Committee on the 18th ult., the Matlock Urban District Council sought to acquire the undertaking of the Matlock Water-Works Company, Limited; to construct additional water and sewage works; and to obtain enlarged sanitary and police powers.

According to the opening statement of Counsel, the Council had entered into a provisional agreement with the Company to purchase the existing undertaking for £18,550—a sum which they considered fair and reasonable. Matlock was a well-known and popular health resort; and it was of the greatest importance that the water should be good. There was difficulty in supplying the district, on account of the high contour; the greatest elevation being nearly 900 feet above the level of the sea. There had been complaints of the insufficiency of water; and the Council had therefore undertaken the work. They proposed to form a new reservoir—the Cuckoostone reservoir—by means of an embankment across the Bentley Brook. This reservoir would have a storage of 111 million gallons, which would be sufficient to supply the wants of the district, and give compensation water of not less than 83,400 gallons every 24 hours. The site of the works was within the district. They had a drainage area of 780 acres; and they proposed to make filter-beds. The Bill also contained a clause to secure to any servants of the Water Company of three years' standing, compensation for loss of office or employment, and pensions if incapacitated by illness or age.

The only opponents of the water portion of the Bill—the two parts being dealt with separately—were the Derbyshire County Council and the Matlock Bath Urban District Council. The petition of the County Council objected to clause 29 of the Bill, which provided that the water should be constantly laid on under pressure, but that the Council should not be required to supply water in any case at a greater elevation than could be reached by gravitation from the reservoirs. They alleged, besides, that there was a danger of lead poisoning, as in floods the water became contaminated by lead. The Matlock Bath District Council sought principally to have excluded from the Bill such portions of the area at present supplied by the Company as were in their district.

Mr. Balfour Browne, Q.C., Mr. Freeman, Q.C., and Mr. A. J. Ram appeared for the promoters; Mr. A. G. Rickards and Mr. Hextall, for the Derbyshire County Council; and Mr. Denman Benson, for the Matlock Bath District Council.

Mr. Balfour Browne opened the promoters' case, and gave particulars of the proposals of the Council. He protested against the appearance of the County Council against the Bill, and said if they had the duty of supplying water he could understand their present action; but this duty, under the Public Health Act, devolved on the Urban District Council.

Mr. Edward Slack, Chairman of the Matlock Urban District Council, gave evidence as to the growth of Matlock and the number of its visitors. The district was the centre of hydropathy; and there were eighteen large hydropathic establishments at Matlock Bath alone. It was therefore necessary that they should have an adequate supply of water. Many complaints had been made as to insufficiency of the present service.

Sir Edward Frankland, Professor Symons, and Dr. Moxon, the Medical Officer of the Matlock Urban District Council, proved the sufficiency of the proposed new supply, and the excellent quality of the water. Sir Edward Frankland said that all moorland water, at some periods of flood, was liable to be contaminated by lead; but any danger of lead poisoning was perfectly removed by filtration through sand or lime.

On the following day, Mr. Henry Rofe was examined. He said he had inspected the works of the Company, and had reported to the District Council that the present service of water was insufficient, and that it was necessary a new source should be found. After negotiations, the Company agreed to sell their undertaking to the Council at a price which, he thought, was satisfactory. He had recommended the Council to obtain possession of certain lands for the protection of the supply. The gathering-ground was 780 acres, principally moorland; the remaining small amount being woods and pastures. He thought it a remarkably clean watershed. They proposed to construct a reservoir at Cuckoostone, that would contain 111 million gallons—sufficient to give them a daily supply of 628,000 gallons. In addition, they would provide filter-beds near the reservoir. In his opinion, all moorland water should be filtered, independently of the fear of lead pollution. He considered there was no possible danger of lead poisoning when the water was properly filtered. The scheme they proposed would give a supply of 30 gallons per head per day on the estimated population for 45 years. In the event of more water being required, they had still a large reserve. With respect to the higher parts of the district, they could supply by gravitation up to 725 feet above sea-level; their reservoirs being at a height of 735 feet. But to serve the small district above this height, would only require a little engine and tank at the highest point; and these they proposed to provide.

On the proceedings being resumed the next day, Mr. Rofe was cross-examined by Mr. Rickards, on behalf of the Derbyshire County Council. The learned Counsel was proceeding to question witness as to the cost of the works, when Mr. Ram objected, on the ground that the water supply was a matter entirely for the District Council; and that the County Council could only intervene if they had reason to suppose that the rights of other districts would be injuriously affected. A long and technical argument followed; and the Committee finally decided that as the points in the petition had been raised and not objected to before the Court of Referees, they were bound to consider them. After some further discussion, Mr. Ram said the District Council would add a proviso to clause 29, providing that nothing in the Act should prevent the Local Government Board from exercising their powers under the 299th section of the Public Health Act of 1875. This would secure that the Board could compel the Company at any time to supply every part of the district. Mr. Rofe's cross-examination was then resumed; but no further evidence of importance was secured.

This concluded the promoters' case; and after a short interval, Mr. Rickards stated that as the promoters had met the County Council fully and fairly in the matters to which they attached great importance, they

had resolved to withdraw their petition. The promoters had agreed to give them the proviso to clause 29; a special filtration clause to secure the purity; and the liberty to take samples of the water at any time. They would therefore withdraw their opposition both to the water and sewage portions of the scheme.

Mr. Denman Benson contended that the promoters should be limited to their own district, and not be empowered to supply water beyond. Mr. Freeman objected; and the Chairman announced that the Committee found the preamble of the Bill proved, so far as related to the water question. The clauses they would consider afterwards.

The Committee then proceeded to discuss the remaining portions of the Bill; dealing with the new sewage works and sanitary and police matters.

Mr. Freeman briefly opened the case; and Mr. Pope, Q.C., on behalf of Mr. R. Arkwright, a landowner, and the Counsel for the Bakewell District Council, contended that the procedure of the promoters was irregular. They should have applied to the Local Government Board, who would have sent an officer to hold a local inquiry, and on his report would have granted a Provisional Order. The learned Counsel, therefore, asked the Committee not to proceed with the sewage portion of the Bill. Mr. Freeman urged that the only effect of this course would have been to oblige them to apply to Parliament twice in place of once.

The Committee deliberated in private; and the Chairman, when the public were again admitted, stated that the Committee considered it would have been more convenient if the two portions of the Bill had been divided. But as the Bill was before them, they had decided to allow it to proceed. If, however, they found any great conflict of evidence on the question, they would follow the precedent of Mr. Walter Long, in the Cardiff case, and strike out of the Bill the clauses relating to sanitary matters.

On Monday and Tuesday, the 23rd and 24th ult., the portions of the Bill dealing with the proposed sewage works was proceeded with. This Committee, at the close, rejected all the sewage proposals, and proceeded to consider the clauses in the remaining part of the Bill. A proviso was added to clause 29, which provides that the Local Government Board shall have power to intervene under section 299 of the Public Health Act, 1875, in case of complaint by water consumers. New clauses were also added for the protection of the Derbyshire County Council. The first provides that all water supplied shall be properly and efficiently filtered, or otherwise treated, so as to prevent it from acting on lead in such a manner as to endanger the health of the consumer. A penalty of £10 per day is to be imposed upon the District Council for neglect. The other clause empowers the County Council to take samples of the water at any time on giving six hours' notice.

LEGAL INTELLIGENCE.

Claim for a Gas-Meter.

At the Westminster County Court last Wednesday, before Judge Lumley Smith, Q.C., Messrs. Alexander Wright and Co., Limited, sued the Gas-Engine Syndicate, Limited, for £50, for a 100-light gas-meter supplied for testing purposes. The delivery of the meter was admitted; but the defendants contended that the dial was only a 13 instead of a 15-inch one, that the bye-pass was not properly made, and that the meter leaked. Plaintiffs denied all this except that the dial was a 13-inch one. They tested the meter before sending it out, and it was all right. It was admitted that the specification was for "a 15-inch dial;" but it was said that 13 inches was the usual size. An offer was afterwards made to supply a 15-inch dial. The size of the dial did not, however, affect the working of the meter. For the defence, the Engineer of the Company (Mr. W. Taylor) said that what was wanted was a dial that could be started from zero at each test, and a 15-inch one. As a matter of fact, the one supplied was only a 12-inch. The meter had never been used; and 30s. a week had to be paid for one in its place. In the result, his Honour found for the plaintiffs for the amount claimed, with costs.

Conviction for Stealing Gas.

At the County of London Sessions, Clerkenwell, last Thursday, before Mr. M'Connell, Q.C., Joseph Lickfold, a plumber and gas-fitter, was indicted for having stolen a quantity of gas, the property of The Gas-light and Coke Company. The prisoner was charged with the offence at the North London Police Court on the 26th ult. (see *ante*, p. 1266); the circumstances being then fully gone into. There were no means of ascertaining how much gas the defendant had used in the surreptitious way then described; but it was shown that during the March quarter this year he consumed about 3000 cubic feet less gas then he did in the corresponding quarter of last year. For the defence, it was contended that the prisoner had made a temporary connection between the inlet and outlet pipes because there was a stoppage of the gas somewhere, and he wished to ascertain whether or not it was in the meter. The Jury found him "Guilty," but recommended him to mercy on account of his previous good character. He was sentenced to a month's hard labour.

New Joint-Stock Companies.—The Universal Water-Meter Company, Limited, has been registered with a capital of £5000, in £1 shares, to acquire the business of a Company of the same name, and to manufacture, sell, and deal in water-meters, valves, fittings, &c. The Baku Russian Petroleum Company, Limited, with a capital of £1,500,000, in £1 shares (of which 750,000 are preference), will purchase or otherwise acquire any petroleum or oil-bearing lands in Russia or elsewhere; sink wells and make borings; carry on the business of dealers in, and refiners of, petroleum and other mineral oils and the products thereof; and acquire, construct, and improve roads, docks, reservoirs, pipe-lines, gas-works, factories, &c. The London and Thames Haven Oil Wharves (1898), Limited, with a capital of £45,000, in £1 shares, will acquire the undertaking of the London and Thames Haven Petroleum Wharf, Limited, and carry on the business.

MISCELLANEOUS NEWS.

THE NEW GAS COMPANIES' ASSOCIATION.

Evidence as to the Necessity for Combination—A Provisional Committee Appointed.

A Meeting of Representatives of Gas Companies to consider the desirability of resuscitating the Gas Companies' Association, or of forming a similar organization, with somewhat extended objects, was held last Tuesday, at the Westminster Palace Hotel. Mr. GEORGE LIVESEY occupied the chair, and was supported by a number of gentlemen connected with gas undertakings of considerable magnitude and influence. The following is a list, arranged in alphabetical order, of those present: Andrews, Thornton (Swansea); Botley, C. E. (Hastings); Braine, C. W. (Wandsworth); Burch, James (Canterbury); Cane, A. H. (Reading); Clarry, G. (Cardiff); Fielding, G. (Dover); Hart, Alderman (Canterbury); Haynes, W. (Maidstone); Helps, J. W. (Croydon); Hoar, Robert (Maidstone); Jackson, H. M. (Brierley Hill); Jones, H. E. (Commercial); Jones, H. H. (Wandsworth); Keys, R. P. (West Kent); Livesey, Frank (South Metropolitan); Monk, Levi (Lewes); Ohren, Charles M. (Crystal Palace); Phillips, A. F. (St. Albans); Phillips, W. R. (Luton); Paterson, R. O. (Cheltenham); Pike, E. S. (Reigate); Pye, James (Chester); Russell, W. J. (Croydon); Shoubridge, S. Y. (Crystal Palace); Smith, C. Crowther (Southampton); Smythe, H. (Maidstone); Stillard, T. E. (Dudley); Thomas, Hanbury (Sheffield); Troughton, W. H. (Gravesend); Ward, Howard C. (Brentford). The names were also announced of a number of other Companies and one Corporation (Huddersfield) who had signified their intention of entering into membership if the Association was formed. The meeting was convened by Messrs. R. W. Cooper and Sons (acting under instructions), of No. 5, Victoria Street, S.W.

The CHAIRMAN, in opening the proceedings, said he had been asked by Mr. Cooper to preside at this meeting, which had been called for the purpose of considering whether it was advisable to start a new Gas Companies' Association. He did not think many words were required to prove the necessity for such an Association. There had been one in existence for many years, which did very good work, and of which a relative of his was the Agent; but as he became incapacitated through age, the Association fell to pieces. He believed that Mr. Cooper had had a large number of inquiries from gas people all over the country as to whether such an Association could not be started again; and this meeting was the outcome of those inquiries. After a few introductory remarks, he thought he ought to call upon Mr. Cooper to state how the meeting originated. He (the Chairman) had a letter from Mr. J. H. Troughton, of the Newmarket Gas Company, which might be taken as a sample of many others that had been received. It was as follows: "The proposed resuscitation of the Gas Companies' Association was considered by my Directors to-day; and they desire me to say that they are in sympathy with the object of the meeting to-morrow, and will be glad to learn what is decided upon, with the view of joining the membership if possible." To show the necessity for such an organization, he (the Chairman) would like to draw attention to a list, issued by the Liberty and Property Defence League, of a number of Bills in which their members were interested. He found that in it there were seven or eight which might affect gas companies. First, there was the Mines (Eight Hours) Bill; but this would not affect them to any considerable extent. Then there was the Steam Engines and Boilers (Persons in Charge) Bill. This was a Bill that, if passed, would require every man who had to attend to a boiler or steam-engine in a gas-works to pass some stupid examination. It was a Bill promoted by the Trades Unions; and it was perfectly well known that its object was to restrict employment, and to restrict employers too. Next there was the Common Employment Abolition Bill. This proposed to extend the liability of an employer to compensate a workman for injuries sustained in his employ to all cases arising from negligence by a fellow servant. This, however, would not affect gas companies now, as he thought the Workmen's Compensation Act settled all these questions for them. Then they had the Boilers Inspection and Registration Bill. This provided for compulsory registration under the Board of Trade; notification of every sale; and inspection (not less than five times yearly) of every steam-boiler in use in the United Kingdom, with penalties for contravention. The objections to this Bill were that it constituted undue interference by the State with trade concerns, and was not necessary in the interests of public safety. It extended the inspectorship nuisance; and was one more step towards the attainment of Socialist ideals that the State should register, inspect, and control every detail of commerce and industry. Next they had their old friend the Public Funds Bill, the object of which was to enable municipalities, in contravention of the Borough Funds Act, 1872, to use the moneys of ratepayers, without their consent, for promoting or opposing Bills in Parliament. The objection to this was that it would remove a useful check upon the extravagance of Municipal Socialism, and upon the growth of municipal monopolies, at the expense of private enterprise. There was also the Local Government Act (1888) Amendment Bill, which proposed to give County Councils—the London County exempted—power to promote Bills in Parliament without the consent of the owners and ratepapers. Now in all these Bills gas companies were more or less interested; and he thought it was very necessary that they should have someone to represent them, and to draw their attention to any such matters that affected them. He believed there was an officer in the City of London who was styled the Remembrancer, and whose sole duty it was to watch the proceedings of Parliament in order to see that the interests of the City were not interfered with. This was his (the Chairman's) opinion as to the necessity of such an Association.

Mr. E. CAMPBELL COOPER, in response to the invitation of the Chairman, said that, in offering a few remarks as to the facts that had called into existence the proposal for the formation of this Association, he should like it to be understood at the outset that his firm had not identified themselves with this matter from ulterior motives of professional interest. They had been asked from time to time to take up the question of the formation of an Association, but had always (to use a light phrase) "let the matter slide," as they were indisposed to associate themselves in the

matter, seeing that it might be considered they were furthering their own professional interests in the guise of forming an Association for gas companies. Certain proceedings in connection with a Bill which they had the pleasure of promoting this year forced upon his mind, and upon the minds of those connected with the Company concerned, that the time had arrived when some steps should be taken to bring gas companies into line, and to resist as far as they could the increasing tendency to municipalize every local enterprise as soon as it began to pay. They felt that very often there was a miscarriage when a Bill got into Committee by reason of a precedent having been formed under a certain set of conditions, which, as a matter of fact, afforded no proper precedent for any particular case; but these so-called precedents were treated as such because the parties had no means of making themselves familiar with the facts under which they were formed. It would be, he apprehended, one of the duties of the Association to keep themselves well posted as to the various facts which from time to time formed the precedents in cases in which (for instance) compulsory purchase was established. But such cases would, of course, be but one branch of the business of the Association. As the Chairman had rightly said, there were various Public Bills which would also affect gas companies—such, for instance, as the Employers' Liability Act, which, he (Mr. Cooper) understood was going to hit gas companies rather hardly, unless they brought themselves into line in the matter. Among others, there was the Borough Funds Bill. He did not know whether gentlemen present had made themselves acquainted with the Borough Funds Act; but one of the main objects of the Borough Funds Bill of this session was to enable corporations to promote Bills without the approval of the ratepayers, unless one-twentieth of the whole number of the ratepayers signed a requisition for a general poll of the inhabitants. They all knew how difficult it would be to get one-twentieth of the inhabitants of a borough to stir themselves up in order to obtain the necessary signatures requiring a poll to be taken; and so matters would be left very much in the hands of the corporations. It so happened that a Bill with which his firm were connected only this year had made it more than ever necessary that this Borough Funds Bill should be closely watched by gas companies. At the instance of a certain Company—he did not know that he need conceal the name, because the meeting was very much indebted to a suggestion which emanated from Mr. Thornton Andrews—at the instance, then, of the Swansea Gas Company, they promoted a Bill this year merely for additional capital. The Corporation opposed the Bill in, as he (Mr. Cooper) thought, a most aggressive spirit. Among other things, they asked for the compulsory purchase of the undertaking—a statutory undertaking which had been doing its duty to the town for years past! They also asked that a list of the shareholders of the Company should be furnished to them periodically, and that they should be allowed a special audit of the Company's accounts—in fact, all along the line, they intended to keep this particular Company under their thumb if they could. The Company were advised that the Corporation would have to obtain the consent of the ratepayers to their opposition to the Bill. The Corporation did not obtain the consent, although they were asking for compulsory purchase of the undertaking; and they actually put upon the file in Parliament a petition under which, had they succeeded, they might have got a clause inserted in the Bill authorizing them to compulsorily acquire the undertaking without even knowing whether or not the ratepayers wanted to be saddled with it. Mr. Thornton Andrews, and other gentlemen who heard of the facts, thought that the position was so strong a one for the formation of an Association—especially in view of the Borough Funds Bill—that they asked his firm whether they would not do what they could to resuscitate the old Association; and, to cut a long story short, they communicated with certain gas companies, with the result that this meeting had been called. He should like to add that, so far as his firm were concerned, they had nothing more to do with the Association than having done what they could to set it on its legs. It was proposed first to form a Provisional Committee, who would lay down what should be the constitution of the Association; and then that the administration of the Association should be left entirely to a Committee to be appointed afterwards as the result of the labours of the Provisional Committee. From that time forward, anything like a personal element in the Association would be eliminated; and the whole administration of the Association would be carried on through the medium of a Committee elected, as it were, on a popular basis. Beyond this he should like to observe that, from conversations he had had with one or two gentlemen on this subject, it seemed that it was thought that the Association should rest on a somewhat broader basis than the old one did—that it should not be merely an Association for watching over Parliamentary Bills, but that, if it was to be of any real good to the gas industry, and be a really live Association, it should be the medium of an exchange of views among gentlemen concerned with gas companies on matters which were of common interest to them, and that they should look upon the headquarters of the Association, and the accommodation provided, as their gathering-ground from time to time, if they thought it worth while to come up to London to exchange views, and take concerted action, in regard to questions of importance in the common interest. He had received a great number of letters expressing approval of the objects of the Association from Companies who were not represented at the meeting, including all the London Companies.

Mr. Howard Charles Ward, the Chairman of the Brentford Gas Company, remarked that, as Chairman of the old Association, he thought it was his duty, as well as courteous, to be present that afternoon to wish God-speed at any rate to the resuscitation of the late Association. Having mentioned several gentlemen who did valuable work in connection with the old Association in its early days, he said he considered it had rather a broader basis than the proposed new one, because it included water companies as well. It was certainly a very useful organization; and it had one of the best Secretaries any association of the kind ever had, but who, he regretted to say, had now become very old. He believed it was because the Secretary passed out of it that the old Association passed away. He referred to Mr. William Livesey. (Applause.) He had no hesitation in saying that his great knowledge, and the way he made himself acquainted with everything that came before Parliament which was in any way prejudicial or advantageous to gas or water companies, was most beneficial to all who were connected with the Association. Directly anything of that kind came along, he called the Committee together. He had everything "cut and dried," and showed them how the Bill would affect gas or water companies; and then the members of the Association called upon their Members of Parliament to give some attention to the passing of the Bills. He (Mr. Ward) thought it only right to mention these facts, in order to give credit to him to whom credit was due; and the whole credit for the usefulness of the old Association was due to Mr. William Livesey. He concluded by moving—"That, in the opinion of this meeting, it is very desirable, in the general interest of the gas undertakings of the kingdom, that an Association should forthwith be formed for the protection of their property, rights, powers, and privileges."

Alderman Hart said, as a Director of the Canterbury Gas and Water Company of 30 or 40 years' standing, he had great pleasure in seconding the resolution. He thought that gas undertakings could not do better than have an organization of this kind to look after their collective interests. The electric light was coming forward as a rival to gas all over the country. In Canterbury only recently the Municipality had taken up the supply of electricity; and in laying their cables, they had come into contact with the Gas Company, and several important questions had arisen in connection with the placing of the cables which had required the greatest care and ability to cope with. He also spoke of other matters which might come within the scope of the Association, and concluded by strongly recommending that a good and well-paid Secretary should be appointed, who possessed the requisite legal training for dealing with the questions which so often arose between local authorities and gas companies.

Mr. C. Crowther Smith (Southampton), speaking in support of the resolution, said that his Company had a Bill in Parliament which had passed the Commons. They had now received from the Hampshire County Council a number of resolutions with regard to the opening of roads and other matters. They sought to impose upon the Company conditions, stipulations, and regulations that were far and away beyond the Gas-Works Clauses Act of 1847—in fact, they were really proposing to repeal the Act, because they asked for a great deal more than it required of gas companies. If this was a sample of what gas companies were to expect from county councils throughout the country, it was one good argument in favour of the companies associating themselves together, in order to obtain sufficient strength to resist county councils trying to legislate beyond an Act of Parliament. Another point had reference to the repeal of the Borough Funds Act. The Southampton Corporation had to call a meeting of the ratepayers in the usual way for the purpose of getting their assent to the opposition to the Company's Bill in Parliament. The Secretary attended, and asked why the Corporation should pledge the ratepayers to spend money in this way when they had not even approached the Gas Company nor told them what was wanted. The result was that a deputation met the Directors, conciliation followed, and no opposition had been needed. It would thus be seen that, if the necessity for holding ratepayers' meetings was done away with, they would lose the chance of letting the ratepayers know there was no occasion for the spending of their money.

Mr. H. M. Jackson (Brierley Hill) spoke of the benefits which his Company had secured by their connection with the old Association.

The resolution was then unanimously carried.

The Chairman remarked that the next resolution would be proposed by Mr. Thornton Andrews. He (the Chairman) had suggested that they should elect, in the first instance, a Provisional Committee, as they did not yet know who would be members of the Association. Those present that day represented various gas companies throughout the kingdom. But it was expected that a much greater number would become interested; and therefore it would be proper that the permanent Committee should be selected from the whole body of members.

Mr. Thornton Andrews (Swansea) said the resolution he had to move was the most important one that would be put before the meeting that day. He was glad that he was to some extent responsible for the calling of the meeting. The necessity for association was undoubted. Combinations and associations of masters and labour of every description had come to the front in the present day; and it was essential, in order to shield the interests of gas companies to the best advantage that they should not only combine but be prepared to defend themselves—not in the way of defiance, but of defence. He concluded by proposing a resolution containing the names of twelve gentlemen who had consented to serve on the Provisional Committee. (See extended resolution below.)

Mr. Jackson seconded the motion.

Several additional names were proposed; and ultimately the resolution was passed in the following form: "That a Committee consisting of twelve or more members should be formed for the purpose of preparing rules for the management of the Association, and for arranging all preliminary matters connected with the formation thereof. And that the following gentlemen be elected members of the said Committee: Messrs. George Livesey, H. E. Jones, Thornton Andrews, Hanbury Thomas, G. Clarry, Sydney Y. Shoubridge, H. C. Ward, W. F. Cotton, C. Crowther Smith, R. O. Paterson, A. F. Phillips, H. Hart, Joseph Cash, J. W. Helps, W. R. Phillips, George Anderson, William King, and Charles Sellers." Some of the gentlemen mentioned in the latter part of the resolution not being present, Mr. Cooper was requested to communicate to them the desire of the meeting that they should serve.

Mr. E. Campbell Cooper was appointed Hon. Secretary *pro tem.*; and the meeting was adjourned to a date to be appointed by the Provisional Committee.

Mr. H. E. Jones proposed a vote of thanks to Mr. Livesey for presiding. He said there was nothing like having a good leader; and if Mr. Livesey would keep in touch with them on the Provisional Committee and also on the permanent one, they would have a good right hand—he might say a good fighting right hand. A number of illustrations had been given by some of the speakers which had struck him as proving that there must be a use for an Association of this character—indeed, all kinds of matters were frequently cropping up which might come within the purview of such an Association. Rating questions constantly came very near to them all. The authorities could alter the rates so as to put an expense upon them equal to 2d. or 3d. per 1000 cubic feet. He remembered writing to their worthy Chairman's uncle asking him if they could not include rating functions among their other duties in the old Association; and it would certainly be a very good thing if their headquarters could be a centre of information on such questions. In many ways gas companies were liable to be harassed; and they were not all of them such good lawyers that they had a bookcase containing all the books required. It would be a good thing to have a centre where they

might refer to text-books on the law, and to get an opinion from their Secretary as to where they were legally in regard to any particular question. He had left off long ago assuming that they could hold their own in this world—especially under odium and suspicion—without a strong right hand. He was sure all present would join with him in a hearty vote of thanks to Mr. Livesey for having consolidated their proceedings that day by presiding over them.

Mr. Ward seconded the motion, which was cordially agreed to.

The Chairman, in reply, said he could not but thank those present very heartily for this kindly expression of feeling towards him. He did not think he had done anything to deserve thanks. To his old friend Mr. Thornton Andrews their thanks were most due; for he believed they were indebted to him for this movement. He felt they ought not to separate without expressing their thanks to him for what he had done.

The meeting heartily acquiesced in the Chairman's suggestion.

Mr. Thornton Andrews, in thanking those present for their recognition of his work, remarked that in these times it was necessary to combine. He found out now that the corporation of one town was not strong enough in itself to fight an incorporated gas company. But the corporations had entered into a combination, or rather an association, called the Municipal Corporations Association; and when one corporation could not tackle a company alone on any question, then that body would fight the battle for them. The object which he had had in view in bringing to the notice of gas companies the manner in which his Company had been treated by the Swansea Corporation had had its effect in the unanimous vote which had been passed to form an Association which should protect their rights and privileges. As a rule, gas companies did not attack the rights and privileges of corporations; it was the reverse. He hoped they would be strong enough to carry through the objects of the meeting. It was no fault of the late Secretary that the old Association died out; it was owing to the security which the gas companies forming that Association felt in leaving the matter in the hands of Mr. William Livesey. The Companies became neglectful of their own interests, and did not back Mr. Livesey up as they should have done. He hoped the representatives of companies forming the new organization would meet together from time to time to consider matters of a legal character.

Mr. R. Hoar (Maidstone) inquired whether the Provisional Committee would consider the question of workmen's compensation, seeing that the Act came into force on July 1, and they did not know when the next general meeting of the Association would be held. It was a question whether gas companies did come within the Act, and whether their employees would have the benefit of it. Insurance companies, however, were asking very largely increased rates. Mr. Livesey had kindly sent his Company a report on six months' working of the Accidents Fund of the South Metropolitan Gas Company; and it was an extraordinary feature that the number of accidents had more than doubled since the fund was put into force. Therefore, they could not wonder that the insurance companies were going to put up their rates. He would like to know whether the Provisional Committee would deal with this question at once. It would be a very great advantage to gas companies, who were being asked something like ten times the former rates of premium.

The Chairman: Then do not insure. Proceeding, he said he thought they might take it that all gas companies came within the Act so far as machinery was employed. If they had two retort-houses, and in one machinery was employed and in the other the work was done by hand labour, the one came under the Act and the other did not. The best plan was to adopt the Act entirely, and assume they were under it; and and then be their own insurers. His opinion was, speaking from experience, that it could be done. In the case of the South Metropolitan Gas Company, it cost them for all accidents over five years about 5s. per cent.; and for the first six months' working under the rules of their own Workmen's Accident Fund, it had cost them 7s. per cent. This was for everything; whereas what they would have had to pay under the Act would have been less than half of this, because nothing had to be paid for the first fortnight, which counted out half the expense.

This concluded the proceedings.

WATER GAS IN THE GARSTON DISTRICT.

The Proportion Supplied by the Liverpool Gas Company.

At the Meeting of the Garston District Council last Tuesday, a letter was read from the Liverpool Gas Company in reply to the protest the Council decided on May 3 to address to the Company regarding the proportion of water gas in the gas distributed in the district (*ante*, p. 1079). The letter stated that the Directors were not less anxious than the Council that their customers should not be subjected to any avoidable risk; but they considered that, if ordinary care were observed, no such risk was to be apprehended from the use of the mixed gas now distributed in Garston and the other southern portion of the Company's area of supply. They were unable to comply with the request that, pending the Home Office inquiry, coal gas only should be supplied in the district. The statement made by the Council that there was a predominance of carburetted water gas in the supply was inaccurate, as it could be clearly shown that the proportions of the two kinds of gases had been for several months past exactly equal. As to complaints of bad smells arising at the Garston works, the letter said they were certainly not worse than at an ordinary coal-gas works; and the deposits of spent lime were nearly odourless. He assured the Council that at Garston, as at all the other works of the Company, every endeavour would continue to be made to minimize the disagreeable effects necessarily incident to the manufacture of gas. The Chairman (Mr. J. Pickthall) said the letter was rather important, as it challenged the accuracy of the analyst's statements. Captain Turner said the Company had never before given them any idea as to the proportion of carburetted water gas mixed with the coal gas supplied to the district, although it had been asked for repeatedly. Now they stated that it was 50 per cent.; whereas the Government had refused to allow the Corporation of Stockport to supply more than 25 per cent. Mr. J. Rigby thought it was most dangerous to supply 50 per cent. of water gas; and he characterized the conduct of the Company as disgraceful. He proposed that the Council should write to them stating that the answer was not satisfactory. Captain Turner seconded the motion, and after further discussion it was adopted.

WIGAN CORPORATION GAS SUPPLY.

The Gas Engineer's Annual Report.

In the "Journal" for the 10th ult., the financial results of the past year's working of the gas undertaking of the Wigan Corporation, and the recommendations of the Gas and Electric Lighting Committee in regard thereto, were noticed. We have since received the annual report of the Gas Engineer (Mr. J. Timmins), furnishing details of a more technical character. Broken and defective mains, the result of subsidence from mining operations and other causes, continue to give cause for anxiety; but though the number of breakages in the twelve months ending March 31 last was not nearly so great as in the preceding period, the loss of gas was very serious in two or three cases. At the beginning of the financial year, there were 8357 consumers on the register; at the end, 8777—an addition of 420. This is considerably above the average increase in the preceding ten years. There were 22 more gas cooking-stoves in use at the close than at the commencement of the year. The quantity of coal carbonized in 1897-8 was 28,630 tons, as compared with 27,808 tons in 1896-7—an increase of 822 tons, or at the rate of 2·87 per cent. The gas made was 323,751,000 cubic feet in 1896-7, and 333,388,000 cubic feet in 1897-8—an increase of 9,637,000 cubic feet, or 2·97 per cent.; the quantity sold being 305,344,300 cubic feet in the former, and 309,354,400 cubic feet in the latter year, or an augmentation to the extent of 1·31 per cent. Mr. Timmins explains that the small increase in the consumption over that of the preceding year was the result of taking the meter indices ten days earlier than in the corresponding quarter; thus reducing the annual consumption of gas by nearly 6 millions. The gross and net profits were respectively £24,577 and £11,280, as compared with £24,297 and £9696 in the preceding twelve months, and £16,125 and £3705 ten years ago. In 1892-3, the price of gas was reduced and meter-rents were abolished, lowering the revenue by £3491; while in the following year the sinking fund was increased by £1671, and other financial charges made up a total of £4571 taken from the gross profits. The total length of mains laid at the close of the financial year was 100 miles 31 yards; being an increase of 4 miles 1351 yards. The consumption of gas per mile of mains within the borough last year was 4,571,842 cubic feet, as compared with 4,827,290 cubic feet in the preceding twelve months; the consumption per head of the population in the same area being 3564 and 3477 cubic feet, and per consumer 36,276 and 37,486 cubic feet respectively. A comparative analysis of working results for the past two years appended to the report shows that the capital employed on March 31 last, was £331,621, being at the rate of £11 11s. 8d. per ton of coal carbonized, 19s. 10$\frac{3}{4}$d. per 1000 cubic feet of gas made, and £1 1s. 5$\frac{1}{4}$d. per 1000 cubic feet sold, against £327,999, or £11 15s. 10$\frac{3}{4}$d., £1 0s. 3$\frac{1}{2}$d, and £1 1s. 5$\frac{3}{4}$d. respectively in the previous year. Mr. Timmins says both the gross and net profits are the highest that have been made since the works came into the hands of the Corporation.

GAS AND ELECTRIC LIGHTING AT BURTON-UPON-TRENT.

Extension of the Gas and Electric Light Works—Gas Profits and the Rates.

At the Meeting of the Burton-upon-Trent Town Council last Wednesday, the minutes presented by the Gas and Electric Light Committee set forth that a report had been received from Mr. Frank Bailey, who had been consulted on the subject of certain faults which had occurred in the electric lighting system, and who had recommended the construction, at a cost of £198, of fuse and junction boxes for the high-tension circuits, to facilitate the localizing of any faulty section. A report on the same subject by Mr. F. L. Ramsden, the Gas and Electrical Engineer of the Corporation, had also been received. The Committee resolved to request the Finance Committee to take steps to obtain sanction for a loan of £19,790 for gas-works purposes, and one of £11,000 for the electric light undertaking. The revenue account of the Gas Department for the year ending March 31 shows that the sale of gas produced £33,031, as compared with £33,340 in the preceding twelve months; and that the total receipts were £42,263, against £42,380. The total expenditure was £36,733, as compared with £35,652 (coals costing £380 more, and wages £162 more); and the net profit was £5529, against £6728.

In moving the adoption of the minutes, Alderman Lowe remarked that the profits during the past twelve months had been £200 more than the Committee ventured to expect about a month ago. The net profits, after paying interest on the loans and repayment of loans, was £5529; the gross profits being £11,614, or equal to 21 per cent. on the capital employed. The amount of the reserve fund was £10,498; and of the depreciation fund, £9300—making in round figures £20,000. As to the relief of rates out of the gas profits, he might mention that the Birmingham Corporation handed over last year £25,000 towards the improvement rate. They in Burton paid £5529 out of the gas profits towards the rates, which was a much larger proportion than at Birmingham in comparison with the population and the rateable value of both places; and, as far as he was able to ascertain, there was no town in the kingdom, in proportion to its population, which paid a greater sum out of gas profits in aid of the rates. The total capital expended on the gas-works was £152,692; but the amount repaid was £98,126, which left outstanding loans at £54,566. These, he thought, were matters upon which they might congratulate themselves. The Manager had presented a report, in which he had intimated to the Committee that the time had come when the works should be extended; and his suggested enlargements—which he estimated would answer the purposes of the Corporation for ten years—involved an outlay of close upon £20,000. Of this sum £9540 was put down for a new retort-house, which must be proceeded with at once. The expenditure to be incurred was large; but they had to remember that a reasonable return might be expected. Then they wanted power to borrow £11,000 in aid of an extension and improvement of their electric light system, which would be in full use next winter; and it was anticipated that this expenditure would carry them over the next five years. Alderman Lowe then passed on to deal with the interruptions which had taken place in the supply of the electric light; and referred at some length to Mr. Bailey's report.

This gentleman attributed the troubles to the use of unsuitable insulating material; and he added that until the junction-boxes recommended by him were fixed, it was impossible to ascertain accurately the condition of the mains. Mr. Bailey had also been asked to inspect the works, and give his opinion as to the site, plant, and future development. He reported that the site had been admirably chosen, and allowed for extensions of the plant. As to the advisability of putting up duplicate works, which had been suggested, he said the principle of having two complete works feeding into a common system of mains, had advantages in certain cases; but in that of Burton he was not prepared to recommend it. He therefore unhesitatingly advised the Corporation that it would be much safer for them to rely on one good works than to incur the heavy expense attending duplicate ones. Alderman Lowe went on to remark that the Committee had come to the conclusion to recommend Mr. Bailey's report for adoption.

In the course of the discussion which followed, Alderman Harrison took exception to the line followed by Alderman Lowe in estimating the profits on the gas-works. The Alderman had based his estimate upon the amount of the loan at present outstanding, whereas, to give a fair idea of the profit made, it should be upon the amount of capital originally borrowed. Councillor Lowe protested against the assumption that, because the gas-works were the property of the Corporation, the price of gas should be kept at an excessively high figure in order to help the rates. He mentioned that in Birmingham the charge was only 2s. per 1000 cubic feet. Mr. Lathbury said Alderman Lowe had not told them that the profits on the gas-works were £1400 less than in the previous year. This, he said, would not have been the case had the price of gas not been lowered 2d. per 1000 cubic feet; which meant £1400 less in relief of rates. Councillor Lowe said they had to deal with the price of gas on a business footing, apart from the rates; and he argued that the Committee, of which he was a member, were justified, in fairness to the consumers, in reducing the charge. Even now, he said, their price was rather above the average than below it. Alderman Lowe maintained that the view he took of the matter was one which would commend itself to business men. He went on to say that if the gas-works were in the hands of a private company, the price would be lower; and that while he agreed that the ratepayers, to whom the works belonged, and with whose money they were worked, were entitled to a fair share of the profits arising from the undertaking, they were not entitled to a share which would amount to more than a private company could legally make. As he had already stated, no town made a larger grant than did Burton in relief of the rates, in proportion to its population. If the £1400 mentioned by Mr. Lathbury had also been given, it would only have meant a reduction of 1¼d. in the pound; but the rate had gone up by much more than that, though no less than £9000 had been contributed by the Gas Department.

The report was agreed to.

HOURS OF LABOUR AT THE DEWSBURY GAS-WORKS.

The time of the Dewsbury Town Council was occupied—it might almost be said wasted—last Tuesday, in an attempt to get up a grievance on the subject of the hours of labour at the gas-works. The introduction of inclined retorts necessitated a re-arrangement of the retort-house work, which has been so greatly reduced that the men scarcely know how to fill up their time. They were nevertheless confined to the works; and while the Gas Committee were willing to recognize this, they did not wish to leave themselves unprotected in the event of unforeseen troubles arising. To secure this protection, an agreement of service was drawn up by the Town Clerk, to be entered into by the Corporation and the men. Its terms were that the men should remain in the employ of the Corporation for a stipulated number of months, that the number of shifts should be reduced, and that the men not actually engaged in stoking should turn their hands to anything which the Manager (Mr. C. A. Craven) might think it necessary to have done. The men are thus assured employment for a certain period, and enabled to earn some 23s. or 24s. per week during the slack season. This agreement does not appear to give satisfaction to the Gas Workers' Union or to certain members of the Council; and when the minutes of the Gas Committee came up for confirmation, Mr. M'Cann moved as an amendment that a letter received from the Secretary of the Union, and also the draft agreement, should be referred back. It was stated during the discussion, however, that so well satisfied did the men appear to be with the management, that only some five or six of them were members of the Union, while the thirty or forty men employed averaged thirteen years per man in the service. No further testimony is needed that the treatment they have received has been fair and reasonable. The men also welcomed the agreement submitted to them, as shown by the alacrity with which they signed it. A curious incident in the discussion was the fact that the councillor who moved the resolution sanctioning the arrangement in Committee should support the amendment referring it back. The position was ludicrous. The Chairman of the Committee was, unfortunately, absent; but Mr. Rhodes made a trenchant reply, in the course of which he exploded all the fallacious arguments put forth by the supporters of the amendment. He did not hesitate to put on the paid agitators the blame for the discussion; and he was particularly strong in his denunciations of a Batley councillor who was trying to pose as a social reformer in Dewsbury, while his own Corporation were paying 3d. per man per shift less than is being paid at Dewsbury. Another member of the Council emphatically endorsed Mr. Rhodes's remarks; and the whole allegations toppled to the ground. A local paper, commenting upon the discussion, says: "If charges are levelled at the heads of a Committee, they should certainly be backed up by facts, and not by the twaddling of men unacquainted with the circumstances, and lacking the wisdom to make personal investigation, before giving themselves over to the championship of the cause of the paid agitator."

The Bolton Corporation and Gas Traction.—The Bolton Corporation have abandoned all intention of using gas as a motive power for the local tramways, and are now considering contracts for the introduction of electric traction.

PERTH CORPORATION GAS SUPPLY.

The Annual Accounts.

The accounts of the Perth Gas Commissioners for the year ending the 30th of April last have been made up, and were recently submitted to a meeting in Committee. The receipts amounted to £22,909, while the expenditure was £17,709—leaving a balance of £5190. The revenue from gas at 3s. 2d. per 1000 cubic feet, less discount, amounted to £19,643; while coke, tar, and naphtha produced £1251, £1078, and £765 respectively. The sum of £138 was received as rental for gas-stoves. The expenditure included £9051 for coal, £425 for oil, £5006 for salaries and wages, £1212 for rates, taxes, and feu duties. There was a balance at the beginning of the year, which, added to the surplus receipts, brings out a total of £5791. This was applied as follows: Annuities, £2812; interest on debt, £1178; sinking fund, £1000; and contingency and depreciation of works fund, £500—leaving a sum of £301 at the credit of the revenue account. The general balance account showed assets amounting to £127,593. These included £90,000 for the gas establishment (works, mains, meters, &c.), £7388 for the extension and improvement of works, £16,728 expenditure under the Act of 1897, £1431 on gas-stoves account, and £2293 on the meter accounts, £2000 being for slot meters. The accounts, which have been audited by Mr. R. Morison, Accountant, show that the gas charge was quite as much as in the preceding year, though the rate was 3s. 2d., as compared with 3s. 6d. The amount paid for coal shows a large increase, which has diminished the year's net revenue. The Manager (Mr. A. Wilson) explained that this had arisen from the better quality of gas supplied since the beginning of January last. Appended to the accounts are tables showing the quantity of gas delivered, the price per 1000 cubic feet, and the percentage of unaccounted-for gas annually since 1873; a comparison between the estimates and the actual accounts of revenue and expenditure for the year; and the apportionment of the wages accounts, salaries, and number of consumers. The quantity of gas delivered in 1873 was 41,000,000 cubic feet; the price at that time being 5s. 10d., and the percentage of gas unaccounted for 13·90. Last year, 138,357,000 cubic feet were sent out; the price being 3s. 2d., and the percentage of leakage 7·89. The number of consumers last year was 7673—being an increase of 311 on the previous year; while 1070 prepayment meters are now in use.

DUNDEE CORPORATION GAS AND ELECTRICITY SUPPLY.

The Annual Accounts.

The accounts of the Gas and Electricity Departments of the Dundee Corporation were submitted to the Gas and Finance Committees of the Town Council on Friday, the 27th ult. These showed a deficiency in the revenue of the Gas Department of £314; and a surplus on the Electricity Department of £1328. It was explained that the deficiency on the gas account arose from the fact that the additions to old chimneys, amounting to about £707, and the repair of old meters, amounting to £244, had been debited to revenue. If these sums had been debited to capital, there would, instead of a deficiency, have been a surplus on the gas account as well. After full consideration, the meeting resolved that the charge for gas should be the same as before, and that the new rate for gas consumed through prepayment meters should be fixed at 3s. 9½d. per 1000 cubic feet net. In view of the satisfactory state of the electricity account, it was resolved to reduce the charges for current. Last year for any amount up to 20 units the price was 7s. 6d.; this was reduced to 6s. 8d., while the charge for each unit above 20 units was reduced from 4½d. to 4d. With the view of encouraging the use of electricity as a motive power, it was decided to reduce the price of the current when used for this purpose. Last year the price was left to agreement between the Council and the parties interested, and generally it was charged at the same rate as that to the ordinary consumers—viz., 4½d. per unit. The Committee were unanimously of opinion that the rate should be reduced to 2½d. per unit if taken through a separate meter, and otherwise that it should be fixed at 4d. It was also resolved that the public electric lamps should be charged at the rate of £20 each for those burning the whole night, and £10 each for those burning part of the night—both net. The accounts for the past year show that the estimated revenue in the Gas Department was £84,156, while the actual receipts amounted to £84,312—an excess of £155. It was calculated that the expenditure would amount to £83,524; but the actual expenditure during the year was £84,627—an excess of £1103. The capital account shows the amount expended at the last balance was £209,993; the amount expended this year, £14,939—making a total of £224,932. The quantity of gas delivered during the year ended April 30 was 556,276,000 cubic feet, of which 508,871,700 feet were sold, realizing a net sum of £77,197. On the works the quantity consumed was 5,447,400 cubic feet; leaving 41,956,900 cubic feet (7·542 per cent.) unaccounted for. The quantity of gas delivered was in excess of that sent out in any previous year, and exceeded that of 1897 by 10,807,000 cubic feet. The gas-stove account shows the sum expended up to this year to be £3385; and the amount received from the sale of stoves to consumers, £1110—leaving a balance of £2275. The amount received for the hire of stoves, fittings, &c., in the past year was £188. It is estimated that during the current year 518,050,000 cubic feet of gas will be sold, that 5,500,000 cubic feet will be used at the works, and that the gas unaccounted for will amount to 42,450,000 cubic feet, making the total quantity required 566,000,000 cubic feet. The sale of gas is estimated to yield £82,220. From this, however, has to be deducted discounts (£3465) and bad debts (£200); reducing the estimated revenue from this source to £78,555. To this has to be added £5500 for chemical products, £250 for coke, £100 for coal-waggon revenue, and £1 for transfer fees (debenture stock); making a total of £84,496. The balance due by the Electricity Department is put down at £381; so that the total revenue is estimated to amount to £84,878. It is calculated that the expenditure will reach £84,863; leaving an estimated surplus of £15. The expenditure of the Electricity Department was estimated at £5284 but it actually amounted to £4941—being £343 below the estimate. The income was calculated at £6000, and amounted to £6269—an increase of £269; and an excess over actual expenditure of £1328. For the current year the revenue, including a balance of £946, is put down at £7553; and the expenditure at £7039—bringing out an estimated surplus of £514.

ST. HELENS CORPORATION GAS SUPPLY.

Annual Financial Statement.

At the Meeting of the St. Helens County Borough Council last Tuesday, Alderman Cook, in moving the adoption of the minutes of the Gas and Lighting Committee, made his annual statement respecting the financial results of the trading for the past year. He said he hoped the Council would consider the outcome to be as satisfactory as the Committee did, especially remembering that twelve months ago they reduced the price of gas by 1d., which was equal to £1000. The total make of gas during the year was 270 million cubic feet, or an increase of 5·38 per cent. for the year. The quantity of gas sold was in round numbers 254 million feet; showing about the same increase as in the previous year. Of this quantity the coin meters had passed 295,857 cubic feet, or an increase of 40 per cent. on the previous year. This was a very pleasing feature in the operations of the gas-works. The number of consumers was being very largely increased, and spread over a considerable area; and now that they would have more or less the competition of the electric light, it was satisfactory to know that the cottagers and small householders were beginning to appreciate the advantages of gas in the house. They took in cash by these meters during the year £4112—an increase of £1032 on the previous year, or about 34 per cent. Perhaps it would be of interest to the Council to know that the weight of the coins was about 8½ tons. The average illuminating power of the gas, ascertained by 284 tests, was 18·89 candles. The unaccounted-for gas was 4·93 per cent.—just a fraction over the previous year. He was glad to say that they had never produced gas so cheaply as they had done during the past year; the cost having been about 1d. per 1000 cubic feet less than in the previous year. The gross profit had amounted to £16,509; and the net profit was £5107, which was the largest ever made in one year by the gas-works. Of the gross profit £10,204 had been paid for interest and sinking fund, and £1197 for depreciation of meters and stoves. The Committee had handed over £2000 of the net profit to the borough funds, and had decided to carry £3107 to the reserve fund, which would then stand at £10,954. But inasmuch as £2667 had been spent during the year in the reconstruction of two of the gasholders, the Committee had resolved that this should be paid out of the reserve fund, which would be left at £8287. They did not recommend any reduction in the price of gas except for motive power, for which 2s. per 1000 cubic feet would be charged inside the borough, and 2s. 6d. outside. The average net price received for gas had been 2s. 3·96d. They had connected during the year 520 new consumers; making a total of 6468. They had also fixed 379 additional cooking and heating stoves, &c., and had erected 49 more public lamps; making the number of the latter 1579. Their Engineer had been endeavouring to grapple with the difficulty of the deposition of naphthalene in the distribution system. They had made practical experiments, and believed they had quite overcome the difficulty; but they would not make a final pronouncement until another winter had passed. The works were in a perfectly good condition; and the entire management of the gas-works reflected the greatest credit on their Manager.

Mr. Dixon Nuttall seconded the motion, which was agreed to.

COVENTRY CORPORATION GAS SUPPLY.

The Annual Report.

At the Meeting of the Coventry City Council last Tuesday, the Gas Committee submitted their annual report, of which a notice appeared in the "Journal" issued the same day.

Alderman Andrews, in moving the adoption of the report, said the supervision and control of the gas undertaking was not an easy task. One of the greatest difficulties they had was the impossibility of forecasting at the beginning of the year what the consumption of gas was likely to be. The average, or probable increase of one year over the preceding year, was about 4 per cent.; but in the year before last, they had a sudden increase of not less than 24 per cent., which meant one-fourth increase unexpectedly in a single year. This put some little strain upon the works; but nevertheless, they managed to produce the amount of gas required, generally to the satisfaction of the citizens. At the beginning of the past year, the Committee also anticipated some increase over the previous year; but the result of the twelve months' trading was that there was no increase at all—the consumption being almost exactly the same as in the previous year. Therefore, while one year they had an enormous increase, and were prepared for a moderate one, they had the next year no increase at all. The other main point he wished to draw attention to was the introduction of water gas. One effect of this had been that they had used 25 per cent. less coal. They had only carbonized 35,299 tons, as compared with 47,408 tons in the previous year. A result of the decrease in the consumption of coal was that, whereas in the winter before last they had to cart coal from the railway to the works the whole of the twenty-four hours, to the great annoyance of householders, they had during the past year been able to do the whole of the carting in the daytime. They had carbonized 12,000 tons of coal less, and had therefore had a smaller quantity of coke to dispose of, and consequently were able to get a somewhat better price for it than in the previous year. On the other hand, they had used half-a-million gallons of petroleum. They also paid £400 less in workmen's wages, because the manufacture of water gas required less labour than the making of coal gas. Owing to variations in price, there had been a decrease in the receipts for tar. Rates and taxes had increased by nearly £300 owing to the advance in the assessment of the works. The year's trading had resulted in a profit of £14,432, as compared with £16,049 in the previous year, or about £1600 less. Out of this the first charge was interest on capital; and the annual charge to the sinking fund. These had amounted to £10,374, as compared with £9927 in the previous year—an increase of £400. This was mainly owing to the change in the method of borrowing loans and the issuing of stock. They might expect the charge to be less this year, as they would only have to pay 2¾ per cent. interest instead of 3¼ per cent. After meeting these charges, the net surplus was £4190, as against £6254 in the previous year, or about £2000 less. This was explained by the fact that, in the beginning of the year, they reduced the price of gas to the smaller consumers by 1d., which made a difference of £817; and in the item of tar, there was a decrease of £1171. The net proceeds from the sale of residuals amounted to 33 per cent. of the cost of coal and oil, as compared with 42 per cent. This explained the large decrease in the available amount of surplus profit. Looking for a moment at the coming year, it was hardly likely that they would have so great a surplus profit at the end of the year, although the Gas Committee would endeavour to balance their finances so as to produce something like the amount. It was anticipated that there would be a rise in the price of coal owing to various causes, one being the Workmen's Compensation Act. Probably this would make £500 difference in the cost of coal. Further, owing to the war between Spain and America, the price of oil had gone up; and they might expect a considerable increase in this item. Taking it all round, he was afraid that the probability was not so great of having so large a surplus as this year. Notwithstanding these rises, it would be impossible to increase the price of gas to make up the difference, while the electric light was being sold at anything like its present terms.

Mr. Kinder seconded the motion.

Mr. Drinkwater mentioned that he had heard a complaint that, with a turnover of £68,000, the profit should be more; but he was quite satisfied after hearing the explanation of Alderman Andrews.

Mr. Lee congratulated the Committee upon the year's work, but was sorry to hear the Chairman's remarks as to next year's profit being likely to decrease. The ratepayers had been accustomed to look for £4000 every year; and he hoped the Committee would be able to keep to this sum.

Alderman Andrews, replying upon the point as to the relation of the profit to the turnover, said that the profit was rather more than 20 per cent. on the present turnover. If this was not satisfactory, it would be better for those who were not satisfied to say what they wanted.

The report was adopted.

PUBLIC LIGHTING AT PLYMOUTH.

An Estimate of the Cost of Incandescent Gas Lighting.

The Superintendent of the Liverpool Corporation Lighting Department (Mr. C. R. Bellamy, Assoc.M.Inst.C.E.) has presented to the Corporation of Plymouth a report on the public lighting of the town, with suggestions for its improvement. By Mr. Bellamy's advice, the Corporation recently decided to purchase from the Gas Company the lamps, brackets, and lanterns, with the view of undertaking complete control of the lighting. The present report, in furtherance of this policy, suggests means by which the efficiency of this branch of the public service may be increased. It appears that the present lighting is effected by means of 1726 ordinary lamps and 249 high-power lamps of the flat-flame type. Reckoning the gas at its standard value, these have an aggregate lighting power of 32,242 candles; and they are estimated by the Borough Surveyor to cost, with the necessary additions, for the present year £6214 10s. 3d. With regard to the future, Mr. Bellamy says street lighting by the incandescent gas system has passed beyond the experimental stage, and practical results on a sufficiently broad basis are now available. It was introduced in Liverpool in 1896; and 45 miles of streets are now lighted on this system, involving the use of 2362 lamps. The light obtainable from the gas used has been ascertained to be about five times greater than with the old type of burner; while the additional maintenance charge for all purposes does not exceed 6s. per burner per annum, under the present prices of incandescent gas-fittings, which are likely to be largely reduced in the near future. Having regard to these facts and the condition of the existing lamps in Plymouth, Mr. Bellamy recommends the Corporation to adopt the incandescent gas system of lighting throughout the town. For the purpose of estimating the cost of this recommendation, he has looked fully into the local conditions and requirements, and has arranged the whole detail of the lighting, maintenance, &c., of the lamps under the management of the Corporation, including the division of the borough into suitable lighting districts, and the preparation of the necessary diagram and schedule of the lighting hours. His estimate covers the cost of the acquisition of the existing columns and brackets, &c., the furnishing of new lanterns with the necessary fittings, including fixing and all other charges, and also the interest and sinking fund to meet the capital expenditure. Provision is also made for a suitable superintendent, inspector, foremen, fitters, &c., the rent of office and workshop, and other incidentals. The estimate is based upon the assumption that the present number of lamps will be maintained, though it will be found that a considerable number will be unnecessary with the more powerful light, especially in the back streets. The capital expenditure is estimated as follows: The transfer of columns, brackets, &c., under agreement with the Gas Company, £2500; 1975 new copper lamps fitted with incandescent burners and fixed complete, at £3 each, £5925; 25 new columns and lamps, at £4 10s. each, £112 10s.; contingencies, £426 17s. 6d.—total, £8964 7s. 6d. With regard to the annual cost, the estimate is: Gas and maintenance, £3312 7s. 6d.; salaries and wages, £1765; rent, stationery, &c., £150; interest and sinking fund, at 6½ per cent., £585; 60 oil-lamps for the Lava district, which is beyond the limits of gas supply, £210—total, £6022 7s. 6d. The aggregate lighting power of the street-lamps would be raised from a possible maximum, under the present system, of 32,242 candles to a minimum of 114,400 candles. In other words, the lighting would be increased nearly fourfold; the pillars, lamps, &c., would become the property of the Corporation; while the annual charge would be reduced by £200. "I have not," says Mr. Bellamy, "dealt with the question of electric lighting, though you may elect to adopt it in positions where cost is not the primary consideration, such as the Hoe, the Promenade, &c. But it may be of service to you to know that I have found the first cost of a 10-ampère Brockie-Pell double lamp, with column and fittings, including two side arms fitted with 16-candle power incandescent electric lamps for use after midnight in place of the arc, to amount to £55; while the annual maintenance charge under a system of midnight reduction, and charging electricity at 3d. per unit, amounts to £21 8s. 7d."

The Works Committee of the Corporation, to whom the report has been submitted, have deferred consideration of it. It is improbable that any action to give effect to the recommendations will be taken at present.

Just now the Plymouth Corporation are opposed to incurring new expenditure which can be avoided—the effect of a too lavish outlay on public works recently having been a large increase of the rates; while there is the additional fact that the electric lighting scheme is being rapidly pushed forward with a view to its being put into operation in the coming winter. The Corporation may therefore deem it advisable to postpone consideration of the question of incandescent lighting until the illumination of the principal streets and the Hoe by electricity is accomplished. Mr. Bellamy's estimates may nevertheless be useful in directing attention to the comparative cost of gas and electricity.

ELECTRIC LIGHTING NOTES.

The York City Council have received the sanction of the Local Government Board to the borrowing of £20,000 for electric lighting purposes. The works are now to be pushed forward; so that within a few months the light will be established in the city.

Under an arrangement which has been arrived at between the St. Helens Corporation and the local Tramway Company, the former are to supply electricity for traction purposes at the following rates: 2d. per unit on a guaranteed consumption of 200,000 units per annum; 1½d. per unit for 400,000 units; 1¼d. per unit for 600,000 units, and 1d. per unit if the tramways are extended in such a manner as to require 800,000 units per annum.

The Electric Lighting Provisional Orders Bill (No. 12), which has lately been issued, contains two Orders granted by the Board of Trade to the Vestries of Bermondsey and St. Marylebone, empowering these bodies to supply electricity "for all public and private purposes" throughout the whole area of their respective districts. Each Order sets forth a list of the streets along which distributing mains must be laid within a period of two years; and it is provided that, in the event of the surplus revenue exceeding 5 per cent. on the capital expended on the works, the Vestries "shall make a rateable reduction in the charge" for electricity. The surplus is to be devoted to local improvements, "or in reduction of the capital moneys borrowed for electricity purposes."

In a note last week, we referred to the considerable growth of the demand upon the Blackpool Corporation Electricity Works, as shown by the repeated applications for loans required for extensions. This week we are able to give the financial results of the working during the past year, from figures supplied at the recent meeting of the Council by Mr. J. Brodie. He said the gross profits of the department had been £5675. The interest on capital and sinking fund claimed £3856; so that the net profit was £1819. A concession was going to be made to the consumers by the abolition of the rent charged for meters, which would mean a decrease in the receipts to the extent of about £300 a year. There was a suspense account of £13,700 for new cables; and until this was paid, the Committee were determined not to let the consumers of electricity have light at a loss to the town. No hope of reduction in the price, therefore, could yet be entertained.

The Corporation of Plymouth are suffering from what has been described as "a cold fit of economy," part of which is probably due to a wholesome fear of the ratepayers, who are indignant because of a sudden and large increase in the rates. In order to satisfy a demand that stock shall be taken of their position and liabilities, the Corporation have called for reports from the several Committees of the schemes in hand or in contemplation, and the cost of their completion. A report by the Electricity Committee is not the least interesting or instructive result. The Committee, who are carrying out a scheme of electric lighting and traction, state that they have obtained the sanction of the Local Government Board to a loan of £45,600. Of this amount, £10,089 was spent up to the 31st of March last; £42,140 will be spent this year; and £3467 next year—bringing the total expenditure to £10,097 in excess of the sum sanctioned. No explanation of this increase is offered or suggested in the report; but no doubt one will be demanded.

The Stockton Corporation have delayed the construction of electric lighting works as long as they safely could without losing the powers which they possess under their Provisional Order. The Board of Trade have from time to time granted extensions; but, on the last occasion, they distinctly stated that they could not agree to another. Only last Tuesday the Council accepted a tender for the construction of the works, on which it is proposed to spend at present about £22,000, although £30,000 is the amount for which application has been made to the Local Government Board. One of the Inspectors of this body (Mr. H. Percy Boulnois) held an inquiry into the matter last Thursday. Among the witnesses was Mr. W. Ford, the Gas Engineer, who is also to take charge of the electrical works, assisted by an electrician. Mr. Ford stated that, if the electric light was not adopted in the town, it was probable that in the near future—no further extension being possible on the present site—the gas-works would have to be removed at a cost of from £100,000 to £150,000. As it was, with the additions to the gas-works last year and the electric light, they would be able to meet the requirements of the town for the next ten or fifteen years.

A significant passage on the subject of danger from fire arising from defective fittings occurs in the report of Mr. A. P. Trotter, the Electrician to the Cape of Good Hope Government. He has previously complained of the unsatisfactory condition of the electric supply in Cape Town, owing to the absence of systematic testing; and he now points out that his remarks under this head have been justified by the occurrence of several fires which have been attributed to defective wiring. Mr. Trotter recommends the fire insurance companies to provide the remedy, by insisting upon the enforcement of similar regulations to those in use in Europe and America for proper insulation and workmanship. Another cause of trouble in Cape Town is the electric tramway service. Against this Mr. Trotter has the complaint that excessive electric pressure causes leakage of the current, with the result that the telegraphic service has been disturbed, and even suspended in some cases, while the water-pipes underground are corroded. Several accidents, including an outbreak of fire, have been caused by the fall of telephone wires across the trolley wire; and the Tramway Company are now called upon to protect the telephone wires from such contact in all cases, instead of only where they cross the roads in groups of six, which was formerly the requirement.

ACCRINGTON GAS AND WATER BOARD.

The Auditors of the Accrington Gas and Water Board (Messrs. Ashworth, Moseley, and Co.) have submitted their statement of accounts for the year ending March 31. They report that the receipts for gas, meter-rental, &c., were £38,023, or about £1000 more than in the previous year. This increase is considerably below the normal for many years past, and is accounted for by the open winter, and the depressed condition of the cotton trade in Clayton-le-Moors, Rishton, and Great Harwood—less gas being consumed in the mills in consequence. The receipts for residual products amounted to £7518, which, with other smaller items, bring up the total revenue of the gas undertaking to £45,967. The receipts for residuals were £1060 less than during the previous year; the prices having dropped considerably—particularly in regard to coke, for which, in consequence of the mild winter, there was not the usual demand. It is expected that the receipts from this source during the coming year will be still less than in the past twelve months. At the beginning of the year, there was a profit of £17,587 on the gas account; and at the end the balance profit carried forward was £17,359—a loss of £237, which includes contributions to sinking fund amounting to £3417. The loss is accounted for by the fact that £1600 above the ordinary expenditure has been taken out of revenue for enlargements; the object of the Board having been to spend as much as possible out of revenue in order not to increase capital charges. Respecting the water undertaking, there was an increased consumption, the total receipts for water consumed being £17,868, which, with other small items, brought up the total revenue to £18,125, or about £500 more than last year. After payment to sinking fund of £3412, there was a loss, including a debit balance of £864 brought forward from the previous year, of £2472, which loss would be made good out of the surplus profits of the first two years. The loss is largely explained by the fact that there has been spent out of revenue for the purpose of laying new and additional mains an extra £1900 on the year's nominal expenditure.

SALES OF STOCKS AND SHARES.

On Monday last week, Mr. Alfred Richards sold at the Mart, Tokenhouse Yard, E.C., stocks and shares in several gas and water companies. The first lots consisted of a new issue, by order of the Directors, of £10 "E" 7 per cent. shares in the Aldershot Gas and Water Company; and they were sold at the rate of £16 per share—yielding £4 7s. 6d. per cent. upon the investment. The total amount realized was £2400. The next lots were some £10 "C" shares in the Harrow and Stanmore Gas Company, ranking for a standard dividend of 7 per cent., subject to the sliding-scale; the last dividend on similar shares having been at the rate of £5 5s. per cent. per annum. The shares fetched £12 each, realizing £600, and yielding the purchaser £4 7s. 6d. per cent. Some "A" stock of the Barnet District Gas and Water Company, the last dividend on which was at the rate of 9 per cent. per annum, was next put up, and was purchased at an average price of £230 8s. 4d. per £100; yielding £3 18s. 1d. per cent. A small quantity of "B" stock (last dividend 8 per cent.) was sold at the rate of £202 per £100; yielding £3 19s. 3d. per cent. Some "C" stock was disposed of at the rate of £225 per £100, yielding £4 per cent.; some "D" (7 per cent.) stock, at £162 per £100, yielding £3 17s. 9d. per cent.; and a few £10 "D" water shares, the first call of £4 on which will be made on the 1st prox., at a premium of £4 10s., returning £2 19s. 3d. on the investment. Seven original £20 shares (10 per cent.) in the Melton Mowbray Gas Company were sold for £44 each; returning the purchaser £4 10s. 11d. per cent. It will be seen by advertisements appearing in another part of the "JOURNAL" that Mr. Richards's forthcoming sales include £7500 of stock of the Brighton and Hove Gas Company, £3000 of stock for the Directors of the Colney Hatch Gas Company, £20,000 of debenture stock for the Crystal Palace Gas Company, £5000 of stock for the Guildford Gas Company, 150 shares for the Whitchurch Gas Company, and £15,000 of Brentford gas stock.

The Proposed Purchase of the Ashburton Gas-Works.—In reply to the request of the Urban District Council, the Ashburton Gas Company have expressed their willingness to sell the gas-works to the Council. They fix the purchase price at £2000; the Council to pay the cost of the transfer as well as for the stock on hand, and the ground-rent of £2 10s. per annum. A Committee has been appointed by the Council to consider the offer.

The Singapore Municipal Commissioners and the Gas-Works.—At the meeting of the Singapore Municipal Commission on the 11th ult., a letter was read from Mr. A. Ford, the Manager of the Singapore Gas Company, submitting a copy of a resolution unanimously passed at an extraordinary general meeting of shareholders held in London on the 14th of April as follows: "That the Directors be authorized to negotiate with the Municipal Commissioners of Singapore for the sale of the Company's plant, goodwill, and business; the amount to be ascertained by friendly arbitration." To facilitate the negotiations, Mr. Ford made the following suggestions: (1) That the Municipal Commissioners proceed to appoint their expert—the Company doing likewise; (2) the two experts to nominate an umpire; (3) the place of arbitration to be mutually agreed upon. He drew the Commissioners' attention to the fact that the existing contract for public lighting by gas would terminate on the 31st of December next, and if it was their intention to use gas for public lighting after that date, he pointed out that no time should be lost in making the necessary arrangements, otherwise the Company might not be able to obtain the materials requisite for the continuance of the public lighting. The President (Mr. Gentle) remarked that he, for one, protested against the Commissioners being bound by the award of any three experts. It would never do for a Corporation situated as they were, who did not want to run a gas undertaking, but were almost compelled to do so, to get out an arbitrator at (say) a cost of £1000, and then find that they were not prepared to pay the price agreed upon. He would suggest that the letter be referred to a Committee, with instructions to ascertain at what price the Company were prepared to sell. This was agreed to.

METROPOLITAN WATER SUPPLY COMMISSION.

Twenty-fourth Day—Monday, June 6.

(*Viscount* LLANDAFF, *Chairman*, *Sir* JOHN E. DORINGTON, Bart., M.P., *Sir* G. B. BRUCE, M.Inst.C.E., *Major-General* A. DE COURCY SCOTT, R.E., *Mr.* A. DE BOCK PORTER, C.B., *and Mr.* R. LEWIS.)

The sitting took place at the Guildhall, Westminster.

The following Counsel are engaged: Mr. POPE, Q.C., and Mr. CLAUDE BAGGALLAY, Q.C., for the New River Company; Mr. LITTLER, Q.C., and Mr. LEWIS COWARD for the Kent Water Company; Mr. PEMBER, Q.C., for the Lambeth, East London, Grand Junction, and West Middlesex Water Companies; Mr. RICKARDS for the Chelsea Water Company; Lord R. CECIL for the Hertfordshire County Council; Sir JOSEPH LEESE, Q.C., M.P., for the Kent County Council and Kent Local Authorities; Mr. BALFOUR BROWNE, Q.C., and Mr. FREEMAN, Q.C., for the London County Council; Sir R. NICHOLSON for the Middlesex County Council; and Mr. GABRIEL P. GOLDNEY (Remembrancer) for the Corporation of the City of London. The Southwark and Vauxhall Water Company are represented by Messrs. BIRCHAM AND CO.

Sir *Alexander Binnie* was recalled, and further examined by the CHAIRMAN with reference to the partition of the works of the various Companies in the counties of Essex, Kent, and Herts between those counties and the body to be created the Central Water Authority in case of purchase. In Kent this would be done, as it were, by purchasing a certain quantity of water from the wells; the wells under the proposed agreement having previously been partitioned between London and Kent. It would resolve itself into purchasing from the Kent Authority a certain quantity of water, at present undefined, which would be passed on to London. In fact, London would buy in bulk from Kent. As to Hertfordshire, it seemed that the wells in the Lea Valley had reached their limits. This was to be gathered from the recent application of the New River Company to Parliament. If it would satisfy Hertfordshire, an agreement might be come to that beyond a certain stipulated quantity of water, no more should be taken from the county. The springs and wells of the New River Company would be taken over by the new Authority, and Hertfordshire would get its supplies from local sources; all the works being retained by the new Authority, who, however, would be limited in the quantity derived through these works.

Sir J. E. DORINGTON: There is no obligation on the New River Company to supply water in Hertfordshire, is there?

Mr. POPE: Part of Hertfordshire is in the New River Company's area; and within this district they have to supply.

Witness (continuing) said the chief desire of Hertfordshire was to keep in the county the water that was there, and to prevent their natural sources being depleted. This certainly was their position in 1896, when the New River Company proposed to sink further wells in Hertfordshire. In Essex, little progress had been made in coming to arrangements agreeable to the county. The question there divided itself into two—first as to the supply of the county borough of West Ham, and then as to the scattered districts outside that place. Essex, like the other counties, wished to have control of its sources, as well as of the means of distribution. Both Essex and Herts—Essex more especially—had a large growing population.

By Major-General SCOTT: The arrangements he had been discussing for cutting off portions of the water-works were concessions proposed to be made by the County Council to the wishes of the Outside Authorities. In his opinion, the counties, or parts of counties, if they were well advised, would take water from the new body, purchasing their own pipes. This would be the most economical way of supplying the districts. The central body would be under obligation to supply them; they would avoid all capital expenditure except that on distribution pipes; and they would reserve in their own hands the power of water taxation. The other arrangements for partitioning the works would involve certain waste in economy and management. All through these negotiations, witness had felt that separation would be inconvenient and extravagant, and that the Outside Authorities, when they saw what it would cost, would prefer to cast the responsibility on the County Council, or whatever the newly constituted body was, and take the water in bulk.

Cross-examined by Mr. PEMBER: The Lambeth Company were supplying to Croydon, he calculated, a little over 1 million gallons a day; but under the proposed agreement, Croydon was to take no more water—going for its supply to new wells. He knew Croydon had got a new well called the Addington well; but he did not know that a limitation had been put upon them by the Kent Company, by which they could not take more than 2 million gallons a day from it, nor that the Kent Company could impose similar restrictions in regard to other wells that might be sunk by Croydon. In all his estimates, he had taken as a basis the calculations of the Balfour Commission regarding the increase of population in the London district; and he assumed that the population of 11 millions odd referred to by that Commission meant the population of Water London, *plus* that portion of Greater London which was outside.

Mr. PEMBER: Now what do you propose to do with regard to all these outlying Authorities? Do you intend to give them as much water as they want—as much as may be necessary, out of the increased Thames and Welsh supplies; or do you propose to lay hands on these, for the supply of the Administrative County of London alone?

Witness: I understand that they were quite satisfied with the present supply, *plus* 20 per cent. After that, they would be at liberty to go to any sources they thought fit.

Do you propose, in all the evidence that you have given, to leave the Outside Authorities to take care of themselves? Do you intend the Commission to understand that, whether the great scheme of getting water from Wales or the utilization of the 185¼ million gallons from the Thames is carried out, what you propose to do has to be considered as something for the County of London alone?—The concessions I have explained were made to the Outside Authorities, to meet their objections. I confess I do not think it would be wise on their part to do it.

Are your answers, so far as you have touched any of the other Authorities, based on the supposition that the Surrey agreement would, to as great an extent as possible, be applied to them?—Yes. Of course, in the case of Kent the Surrey arrangement would not be workable.

The alternative that you have put before the Commission all along has been, on the one hand, to get 300 million gallons a day from the Thames, supplemented by the chalk and the Lea; and, on the other hand, to take 185 million gallons from the Thames, supplement it by the chalk and the Lea, and bring the rest in from Wales. What are you going to do with all this water, if you give the Outside Authorities nothing more than the present average supply, *plus* 20 per cent.?—We base these calculations on the report of the Balfour Commission as to the total requirements of the whole. Supposing the Outside Authorities were to go away from the Central Authority, and supposing the Central Authority were the London County Council, the County of London would have to provide for 7 millions of people ultimately, instead of the 11¼ millions contemplated by Lord Balfour's Commission.

Then you are opening before us a totally different vista of possibilities from what we have been considering up to now?—I do not think so. The water would have to be brought by the central body or the Companies. If there were to be a partition of works, the whole scheme of supply from the Thames and from Wales would have to be reviewed.

In further cross-examination, witness said he based his division of 11 millions, into 7 millions for Inner and 4 millions for Outer London, on the Balfour report; but the Balfour Commission, he agreed, did not go so far as to apportion the population in this way. These figures related to 1931. If both parties desired partition, there would be no difficulty in effecting it; but should increase of population take place, there would be great difficulty. Witness was then questioned at considerable length regarding the details of the proposed division of works, mains, filter-beds, engines, reservoirs, &c., with the object of showing that his suggestions were unworkable in some cases, and in others would cause friction between the employees of the central body and the Outside Authorities; both sets of men having, in many instances, to work side by side. He maintained in general, however, that if both sides desired partition, there need be no friction among the employees; and he adhered to his view that the partition was quite feasible as a matter of engineering. He had not made any estimate of the cost of carrying out all the various schemes of partition. With regard to the Middlesex County Council, his proposal was to sell off to that body all the new main of the New River Company which, passing from Kempton Park northwards, ran almost entirely through the county of Middlesex outside the county of London; cutting off the distribution pipes of the various Companies outside and joining them up with this main. There would be no difficulty whatever in doing this. The main he referred to was the one starting at the river and pumping first into the reservoir at Cricklewood at 150 feet above Ordnance datum; and then into another reservoir at Fortis Green at 300 feet above datum. He thought this would enable Middlesex to supply their highest districts.

Mr. POPE: The important point to me is that it would hand over to Middlesex the only pipe by which I can get my supply from the Staines reservoirs.

Mr. PEMBER remarked that witness had said so little about Hertfordshire and Essex, that he was hardly prepared then to cross-examine him regarding these counties.

Mr. POPE (to witness): I want to understand you. If I follow the bent of your mind, it is that the difficulties of partition would be so great that practically it is a question of supply in bulk or not at all?

Witness: Not the difficulties of partition. I think what I may call the financial and administrative advantages lie rather in the direction of supplying the Local Authorities in bulk.

You have estimated that the difficulties are so considerable that the only method is to supply in bulk?—I can hardly say that. Notwithstanding all Mr. Pember has put to me, I think, as an engineering matter, the partition can still be carried out. The New River main I propose to hand over to Middlesex was intended solely for the supply of one district of the New River Company; but not only was the main outside London, but outside Water London. In handing over this main, I assume that the eight Companies have been bought; and that the New River Company, as such, has ceased to exist.

You would appropriate the water which the New River Company are authorized to obtain at Staines to the supply of the county of Middlesex only?—Quite so.

Is not the bias of your mind, as placed before the Commission, in truth that the whole consideration leads to the conclusion that partition is not the way out of the difficulty, but that supply in bulk is?—I do not think in this case you can lay down any hard-and-fast line how it is to be done. In some instances you will find partition best; in some, supply in bulk; and in others, the prohibition of taking more water from a certain district. Outside Authorities should be given the option in all cases of continuing to be supplied as at present by the Central Authority; of purchasing in bulk, buying their own distribution pipes; or of having the works partitioned. One course having been selected, the details, failing agreement, could be carried out by arbitration.

If it should turn out that the Commission should come to the conclusion that, as far as Middlesex is concerned, partition is impracticable, then you would say the only alternative is supply in bulk or that they should remain as they are?—Yes.

Suppose Middlesex elects to take water in bulk, to what extent do you propose to supply? Do you take the whole responsibilities of the future?—As regards quantity. The Central Authority would then be placed in the same position as the large towns in the North. They would be bound to supply in bulk to the extent required from time to time.

Subject always to the prior claim of the supplying Authority. That is the usual condition on which Authorities undertake the supply in bulk outside?—It may be so in some cases. It is, however, a legal point on which I cannot speak.

In further cross-examination, witness admitted that difficulty would arise when (say), in the case of Surrey, the supply had increased so as to exhaust the 20 per cent. excess of the present average consumption which was to be allowed. He agreed that the Central Authority, if the supply was to be in the hands of one body, should be placed under obligation to satisfy all future wants. At the same time, he admitted that his great difficulty in effecting the division was not as to engineering, but related to the time when the quantity now agreed upon between the two bodies had been exhausted. The price would be settled by agreement or arbitration, or else by some Government Department. If the Outside Authorities took a supply in bulk, the difference as compared with the present time

would be that the Local Authorities would then have the entire distribution and power to charge in their own hands. They would have much greater control over the price. The learned Counsel would not be right in saying that in witness's opinion, the proposal meant a supply in bulk or no supply at all.

By Mr. LEWIS COWARD: He was aware that the Kent Company objected strongly to the County Council taking their water away from them. He gathered from Counsel that 30 square miles of the Kent Company's district was in London, and 140 miles outside; that the Kent Company had an outside area capable of yielding a larger quantity of water than the inside area; and that they had a much greater volume from the sources outside than was needed for the supply inside. He did not know that in the Shortland section of Beckenham—the only part of Beckenham that the Company supplied—the consumption was between 30,000 and 40,000 gallons a day; whereas the pumping-station there yielded about 2¼ million gallons a day. The total yield of the Kent Company's works was put at 27½ million gallons; but what London proposed to take of this quantity had, he thought, never been decided. Mr. Chatterton who, at a previous inquiry, gave evidence on behalf of Kent, might have said that 27½ million gallons formed the basis of the proposed agreement between the London County Council and the Joint Committee of Outside Authorities in Kent; that London was to have no more than 18 million gallons a day from the 27½ millions; and that the other Authorities were to retain 9½ million gallons.

Mr. LEWIS COWARD: Assuming that the 18 millions was the agreed maximum, do you think it would be enough for all emergencies for London?

Witness: I could hardly say.

Do you think it would suffice for long in the London district?—I could not say.

Regarding the attitude of the Kent Local Authorities, they have always been in favour, have they not, of handing themselves over to the Kent Company?—I do not know that.

By Lord R. CECIL: As to the way Hertfordshire would be treated, he should say that it would be no hardship for London, having purchased the New River Company's works, to agree with Hertfordshire not to draw from the existing sources in the county more than a certain stipulated amount—something like the quantity at present taken. If it were wished there would be no difficulty in the purchasing body continuing to supply the small number of people who were at present served by the New River Company.

Lord R. CECIL: Do you propose to hand over the sources of supply, to supply in bulk, or to get Hertfordshire under the control altogether of the London County Council?

Witness: What I thought was that the London County Council, or the new body, would purchase from the New River Company the existing sources of supply in Herts. They would retain these for the supply of London, but would undertake that they would not draw any greater quantity than was being drawn at present, or any other amount agreed upon. All other sources of supply in Herts outside the works of the New River Company would be left to Herts.

You know that a great objection of these Local Authorities is that a London Authority should have no jurisdiction whatever within their district. If you supplied in bulk, would it not in substance leave the jurisdiction of the London Authority existing in their district? Of course, the vital question is that of rating. If they supplied in bulk, London at any rate would have an important voice in the price of water supplied?—As a seller, it would undoubtedly have a voice.

Especially as Hertfordshire would have no other sources of supply?—I beg your pardon, we are leaving a very considerable portion of Hertfordshire to them. We are taking only a very small part of the county. The rate to be imposed in Hertfordshire would, of course, depend largely on the price paid to London for water.

In reply to further questions, witness said it was a question of supplying Hertfordshire in bulk, or else supplying direct to the consumers. Though it would be quite possible to hand over to the Outside Authorities the pipes and distributing mains, he would not advise the adoption of this course.

Re-examined by Mr. FREEMAN: In the Bills introduced by the London County Council for purchase, they always contemplated taking over the obligations now resting on the Companies; and as Engineer to the Council, he should advise their taking the responsibility of supplying outside districts up to an average of 35 gallons per head daily. The main from Staines to the New River Company which he proposed to hand over to Middlesex was constructed especially to serve, and did serve, a district outside London; so that if it was appropriated for the county of Middlesex, it would simply answer the purpose for which Parliament sanctioned it. The difference between witness's calculations and those of Messrs. Hunter and Fraser which were laid before the Balfour Commission, regarding the Staines reservoirs, was due to Messrs. Hunter and Fraser not allowing for evaporation, silting in the reservoirs, &c., whereas witness allowed for these things. With regard to his estimate of storage capacity, which varied from £320 to £380 per million gallons, he said this included all head works on the river, engines, and the conduits to convey the water from the river to the reservoirs, the construction of the reservoirs themselves, the conveyance of the water from Staines to Hampton, and the cost of land. As he added the reservoirs, he reduced the price from £380 to £320 per million gallons of storage. He had always regarded the construction of the reservoirs at Staines as fraught, he would not say with risk, but with possibly great expense, for the reason that they were situated at the junction of a number of streams—the Colne, the Colne Brook, the Wraysbury River, &c., with the Thames; and at this point there was a large bed of gravel overlying the London clay, about 20 feet in depth. This bed of gravel was so highly charged with water that the late Mr. Harrison, of the Local Government Board, actually proposed it as a source of water supply for London. Having regard to this, witness thought the reservoirs would be very costly indeed in construction. He did not, however, suggest that the reservoirs would be leaky. His figures for pumping were those taken by Messrs. Hunter and Fraser. Regarding the Yrfon reservoir, he had been asked for some particulars, and had declined to give them. He was, however, now prepared to lay them before the Commission. The area of the reservoir would be 3000 acres, its gross capacity 39,000 million gallons, its available capacity 35,700 million gallons (leaving 3300 million gallons for settlement), its extreme depth 160 feet, its area when drawn down 501 acres, the mean available depth 45 feet, the actual depth when drawn upon 81 feet, and the length of the main embankment 4300 feet. The cost of the conduit from Wales would be made up thus: 117 miles of covered conduit, at £43,440 per mile, £5,082,000; 45 miles of pipe, at £59,500 per mile, £2,677,500—together £7,760,000, which worked out to an average of £48,000 a mile. This included the cost of purchasing the land, not merely of obtaining way-leaves.

Mr. FREEMAN: As Engineer to the Welsh scheme, you have been asked a good many questions about it?

Witness: I have.

I think you wish to put very shortly, in one answer, the reason why you, after spending all these years in considering it, have come to the conclusion that this will be the best way out of the difficulty?—That is so. First, I find that the consumption of water, as measured by the rate per head, has risen from 32·68 gallons as found by Lord Balfour's Commission in 1891, to 35·42 gallons. I find that the average increase in the total London water supplies between 1867 and 1891, is at the rate of 2·32 per cent. If we take it on these figures, we find that in 1931 the quantity required for London will be from 442 to 447 million gallons a day; being an increase from all sources on the figures of Lord Balfour's report. But the available quantity in the Lea Valley derived from pumping and wells, as mentioned by Lord Balfour in his report, was not proved—by the fact that the New River Company have had to go to the Thames, and by the fact that the East London Company have never been able to pump their 11 million gallons from their then existing wells—as bountiful as was expected. Therefore it is clear that we shall not get in the Thames Valley quite so much as Lord Balfour suggested. I myself estimate the quantity that we can obtain from the Thames and Lea sources at 300 million gallons. Consequently, this difference must be made good (whoever takes up the London Water Question) from some outside sources; and I think it would be more advisable on the ground of quantity to go to Wales. Then I do not think it is wise to continue to make London, with its vast growing population, dependent on a source like the Thames for more than we can help—that we should have, in case of a calamity, something to fall back upon in the way of uncontaminated water. We can obtain by the Staines scheme 300 million gallons from the Thames. I suggest that we should take 185½ million gallons, with a further quantity obtained in the Thames Valley, making it 300 million gallons. Then bring in the Welsh scheme, and you have a supply of 200 million gallons more—or 500 million gallons—to provide against the future, and one of the sources undoubtedly a very pure and uncontaminated one. My belief is that, whether the supply remains in the hands of the Companies or is taken up by some public body, before long they will have to go outside the Thames Valley; and I think it is more economical to commence doing so at once, rather than spend so large a sum of money as would be required in raising the supply from the Thames from 185½ million to 300 million gallons daily.

In reply to Major-General SCOTT, witness said, under the proposal of the Council in their purchase Bills to limit their responsibility to an average of 35 gallons per head daily, it was intended to include the requirements of very hot or frosty weather, when the consumption was more than 35 gallons a head daily.

Mr. PEMBER remarked that he, and others with him, had been wondering a good deal as to what view the War Office would take of this long conduit from Wales, and whether the Chairman would think it worth while to ask their opinion. It was a matter the Companies could hardly move in; and it might be, the Commission would not think it inside their reference.

The CHAIRMAN replied that the subject was hardly within their reference.

The twenty-fifth sitting of the Commission was held yesterday at the Guildhall, Westminster—Lord Llandaff presiding, and all the Commissioners being present. Mr. R. D. M. Littler, Q.C., C.B., Chairman of the Middlesex County Council and Quarter Sessions, gave evidence regarding the water question as affecting the County of Middlesex. He said that, owing to the heaviness of the rates and of contemplated expenditure, the County was anxious to practise economy. The view the Middlesex County Council entertained with regard to purchase was that it could not possibly do them any good, and might do them a great deal of harm.

The Gas-Works Purchase Question at Wallingford.—The Wallingford District Council are desirous of purchasing the local gas-works; and correspondence has passed between them and the Company on the subject. The latter are not prepared to entertain a proposal to purchase their undertaking at a price to be ascertained by arbitration; but they have intimated that they will consider a definite offer. In consequence of this, the Council have decided to engage Mr. H. E. Jones, the Engineer of the Commercial Gas Company, to value the works.

Suggested Supply of Gas at Cost Price.—At the meeting of the Malvern District Council last Tuesday, Dr. Grindrod proposed that gas be supplied to the ratepayers at cost price, including estimated contingent expenses. He pointed out that there were 1719 houses in the district, and in 945 of these gas was used. Last year the profit of £2218 from the manufacture of gas was wholly applied to the reduction of the district rate; and it was, he urged, an injustice to compel the 945 users of gas to help to pay the rates of the 744 who did not use it. In addition to the £2200, there had been charged to the gas-works account £1166 on account of repayment of loans, management, lamps, mains, &c.; and this sum also came out of the pockets of the gas consumers. The profit of £2218 was equal to a rate of 5½d. over the whole district; and he urged that the proper price for gas should be 2s. 4d. instead of the 3s. 4d. now charged. A reduction would be of the greatest good to tradesmen and to the working classes, and would inevitably lead to largely increased consumption, and consequently increased profits. The present system was against the spirit of the Local Government Act; and the Council should strive to secure "the greatest good for the greatest number." The motion having been seconded, Mr. Nevile moved, as an amendment, that any alteration in the price of gas is undesirable. The risk of starting the gas-works, he said, was undertaken by the ratepayers as a whole; and they were entitled to a fair profit for their outlay. Even if some reduction was desirable, the resolution was too drastic, and the time inopportune. The amendment was carried.

BRADFORD CORPORATION WATER SUPPLY.

Visit of Municipal Engineers to the Nidd Valley Works.

On Saturday, the 4th inst., the Association of Municipal and County Engineers held a Yorkshire District Meeting, for the purpose of visiting the works which are in progress in the Nidd Valley for the supply of water to Bradford. In the absence of the President (Sir A. Binnie), Mr. C. H. Lowe, of Hampstead, was the acting Vice-President. On arrival at Pateley Bridge, the members were received by Alderman Houldsworth and the members of the Bradford Water Committee; and they drove thence to the dam of the Gouthwaite compensation reservoir. Mr. J. Watson, M.Inst.C.E., the Water Engineer to the Corporation, gave a description of the scheme and the works in progress, for which parliamentary powers were obtained in the sessions 1891-2. They comprise three reservoirs on the River Nidd, on the south-eastern side of Little Whernside: (1) The Angram reservoir, situate at an altitude of 1187·50 feet above Ordnance Datum, having an area of 69¾ acres, an available depth of 112 feet, and a capacity of 810 million gallons; (2) the Lodge reservoir, at an altitude of 1098 feet, with a top water area of 84¾ acres, an available depth of 104 feet, and a capacity of 1088 million gallons; (3) the High Woodale reservoir, at an altitude of 994 feet, with a top water area of 72½ acres, an available depth of 61 feet, and a capacity of 698 million gallons. The total storage will be 2596 million gallons. The united drainage area to these reservoirs is 6860 acres. In addition to the drainage to the reservoirs, there is an area of 11,400 acres which drains into, and is intercepted by, the main aqueduct, into which the waters of the following streams are taken: Ruscoe Beck, by 616 yards of 12-inch pipes; Howstone Beck, by 900 yards of 24-inch pipes; Blayshaw Gill, by 217 yards of 18-inch pipes; Ramsgill, by 1328 yards of 24-inch pipes; and Colthouse Beck and a number of smaller streams direct into the aqueduct. The main aqueduct is 32 miles in length, and consists of 11½ miles of channel 5 ft. 6 in. wide by 6 ft. 3 in. high, in cut-and-cover, constructed in concrete; 6¼ miles of tunnel lined with concrete (also 5 ft. 6 in. by 6 ft. 3 in. inside), and about 14⅜ miles of cast-iron and steel pipes 36 inches in diameter, of which 3 miles are steel pipes, weighing 1800 tons, and the remaining 11⅜ miles cast-iron pipes, weighing 13,000 tons. At a point 16 miles distant from its commencement, the main aqueduct is joined by a branch pipe 30 inches in diameter and 2¾ miles in length, from which water can be drawn from the Upper Barden reservoir to the Chellow Heights reservoir in Bradford, or by which Nidd water can be sent into the Lower Barden reservoir. At a distance of 18½ miles from its commencement, a pipe 18 inches in diameter, 310 yards long, is taken to the Chelker reservoir; and at a distance of 22½ miles, the Doubler Stones branch, 6 inches in diameter, is joined to the main aqueduct, 2136 yards long. The total length of branch aqueducts is about six miles. The main aqueduct delivers into two reservoirs at Chellow Heights, at an altitude of 845 feet, having a capacity of 64 million gallons. Five filter-beds are to be constructed at each reservoir for treating the water before delivery into the city. In the construction of the works, seventeen bridges have been erected for carrying pipes and aqueducts over valleys, rivers, and canals. There are five intake dams constructed of masonry for damming back streams which are brought into the main aqueduct by the branch aqueducts noted, on each of which are placed separating weirs; the upper end of each syphon being controlled by automatic valve apparatus to stop the flow in case of accident. The Gouthwaite compensation reservoir, situated on the River Nidd about 2½ miles above Pateley Bridge, will form a lake some two miles in length, and have a storage capacity at 446 feet above Ordnance Datum of 1564 million gallons. The masonry wall or dam is constructed of cyclopean rubble in cement. The maximum depth from the foundation to the top water level is 105 feet, the thickness at the base being 70 feet. On the up-stream side, the wall has a batter of 1 in 16, with a curved batter on the down-stream side. The face and back of the dam are formed with large squared pitch-faced blocks of hard gritstone. The overflow is carried over the crest of the dam through fourteen arches each 31 ft. 6 in. span, over and upon which a carriage road is formed 10 feet in width. The parapets of the road are of pierced and moulded ashlar. Two culverts, each 10 feet in diameter, are constructed through the wall of the dam, controlled by valves and outlet-pipes fitted up in two valve-towers of masonry, lined with cast iron, erected on the inner side of the dam. The drainage area to this reservoir is 9900 acres, which is set apart as a compensation area for supply to those having mills, riparian, or other interests in the stream below. The public road on the westerly side of the reservoir above referred to, has been diverted for a length of 3050 yards, and the occupation road on the easterly side for a length of 983 yards. The quantity of masonry and concrete in the masonry dam is about 70,000 cubic yards. The aqueduct and tunnel will carry 27 million gallons of water per day; but one line only of 36-inch pipe is now being laid, which will carry 10 million gallons per day. The estimated cost of the works when completed is £1,370,000.

The Public Lighting of Winchester.—The Winchester City Council have decided to accept the tender of the Gas Company to light the public streets for the next three years at £1240 a year—a decrease of £73 on the contract which has lately expired. The Electric Light Company's tender was £1313 per annum, or with certain improved methods, £1555.

Meter and Burner Testing in Liverpool.—In the annual report of the Superintendent of Street Lighting, &c., to the Liverpool Corporation (Mr. C. R. Bellamy), some particulars from which were published in the "JOURNAL" for the 10th ult., he gives the results of his tests of gas and electric meters and governor gas-burners in the twelve months ending Dec. 31, 1897. There were 4825 of the Gas Company's meters tested—4720 being wet, and 105 dry. Of the former 9, and of the latter 95, were rejected. Sundry meters to the number of 1719 were tested—1225 being wet, and 494 dry. Of the former, 119, and of the latter 263, were rejected. The total number of meters examined was 6544, of which 987 were of the prepayment class. Of these, 816 were stamped, and 171 were rejected. There were 799 electricity-meters tested; the arger number of them (658) being for 110 volts. Of these, 158 were rejected. There were 8309 testings of governor burners; resulting in the rejection of 491 of them.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The controversy over the question of the transfer of the undertaking of the Peebles Gaslight Company to the Corporation is being conducted by circular—a method which is somewhat reminiscent of the frequent issue of high-sounding proclamations in France during the great war of 1871. The first this week came out on Monday. It was addressed by the Town Clerk to the partners of the Gas Company, and called their attention to the fact that very recently the Chairman of the Company purchased £300 of stock for £450, which is at the rate of £150 per £100 stock; and then he panegyrized the offer of £157 10s., made by the Town Council. The next circular was issued on Wednesday by Mr. W. Young, of Peebles, a Director of the Company, and was addressed to the shareholders. Mr. Young points out that the offer of the Town Council involves a gross payment to the Company of £9135, but that the Town Council would get in return, not only the undertaking and plant of the Company, but £3000 which they have accumulated for purposes of extensions. They would thus pay only £6135, which is equal to no more than £105 15s. per £100 stock. This he considers inadequate. But the important part of Mr. Young's circular is his statement that the Company earn, on an average, a profit of £1000 a year, out of which they have been in the habit of paying a 10 per cent. dividend upon their capital of £5800 (absorbing £580), and carrying forward the balance. He then suggests that the Corporation should take over the undertaking on the basis of paying 10 per cent. redeemable annuities. They would then have, out of their £1000 profit, sufficient to pay the £580 of annuities, and £420 over, which would be available for lowering the price of gas and redeeming the annuities. The third circular was issued by Treasurer Williamson, on Thursday, in reply to that of Mr. Young. Mr. Williamson maintains that the price paid by the Chairman is the full market value of the shares; and he puts forward the argument that, in order to reach a profit of £1000, it is necessary to buy in all the sums set apart for depreciation and renewal—the £3000—and that, if this were taken off, the real profit is reduced to £586 a year. He admits that Mr. Young's offer is ingenious, even insidious; but he considers that it is quite beside the mark, because he wants an annuity which he could sell, and which, on the basis of 3½ per cent.—the rate at which the town can borrow money—would make the price £320 per £100 stock. He repeats that the Town Council will have no arbitration.

This is the narrative. It strikes me that the parties will not get much forward if this form of negotiation is continued. They will require to come into closer contact with each other before they can do business. The difficulty in being able to do this lies in the Corporation maintaining that the Company is dissolved. There is no body for them to meet—only a series of atoms. It seems to me that the Corporation must either give up this position, or it will be necessary for the Company to have their corporate existence established by law. The beginning of strife is as the letting out of water; and it might turn out that litigation would be as costly as arbitration. There is to be no arbitration; but there is great danger of litigation. Let me whisper in their ears that very possibly the legal advisers of the parties would like nothing better; and that this is eminently a case where they should agree with their adversary quickly, and, as people of common sense, frequently take counsel with themselves and settle upon a price. Better than taking up legal positions would be an agreement to seek the advice of a good consulting engineer. With reference to the statements in the circulars, it is pure nonsense to speak of £150 per £100 as the market value of the stock. That is the price which has been paid for shares in a Company which is said to have no existence. The true market value would be the price which would be paid with the knowledge that the Corporation were about to take over the undertaking—that is the figure which would be fixed by arbitration. Any price so fixed would be based upon the 10 per cent. dividend. The shareholders would get as much as would yield them a sum equal to that which they draw, at 10 per cent., from their shares. This would be about three times the present capital. Mr. Young's proposal comes cheaper than that; and it is the only sensible one. The Town Council, under it, would pay annuities for a stated number of years, redeeming, in the meantime, if they chose, whatever shares might fall into the market. Then, at the expiry of the fixed period, it would be open to them to redeem the whole at (say) 25 years' purchase. Now the Corporation hold £200 of stock, which they could at once redeem at par; reducing the capital to £5600, and the annuities to £560. Twenty-five years' purchase of this sum would amount to £14,000. Three times £5800 is £17,400; and thus Mr. Young's proposal would save the town £2800, as compared with what they would pay under an arbitration. I would like to point out how wide of the mark Mr. Williamson is, when he says that Mr. Young brought in every penny set aside for depreciation and renewal, in order to make up the £3000 of accumulated profit. It is the very opposite. Renewals have, for the most part, been paid for out of revenue; and depreciation has been provided for by maintenance of the works and plant in the best condition, which they are in at present. If the Corporation could be induced to look at the matter aright, it would be thus: The Company can go on earning 10 per cent. and more, which means that they can take £580 from the community of Peebles every year. If the Corporation take the undertaking over on the basis of paying 10 per cent. redeemable annuities, they will redeem the annuities out of money derived from the community, through the gas consumption; and the amount, calculated on the basis of 3½ per cent., will, upon three times £5600—or £16,800—be £525 a year. The town's offer of £6135, represents an annual outlay of a little over £190. That is to say, while professing to pay at the rate of £157 10s. per £100 stock, they in reality reduce every £100 of stock to about £34. Knowing this, there can be but two courses open to the Corporation—either to pay the correct value for what they wish to acquire, or to leave the Company alone.

It is exceedingly gratifying to see the continued prosperity of the Perth Corporation Gas Undertaking, in the hands of Mr. A. Wilson, who has now been long enough in harness to show what he is capable of doing. A year ago Mr. Wilson took the bold course of reducing the price of gas from 3s. 6d. to 3s. 2d. per 1000 cubic feet. That he was justified in doing so, is to be found in the result. The quantity of gas consumed has risen from 124 to 138 million cubic feet—an increase of 14 million feet. The revenue from gas is also actually larger—having been £19,643, as against £19,551

a year ago, and £17,873 two years ago. The total revenue—£22,909—is to be compared with £22,593 a year ago, and £20,824 two years ago. Consumers have increased by 311 during the year, as against 510 in the preceding year. The revenue from coke was £1251, as compared with £1202; from tar, £1078, as against £1126; and from naphtha, £766, as compared with £482. The total expenditure was £17,709; and there is thus left the very substantial balance of £5190 gross profit. The net profit is £300. It is not proposed to make any alteration in the price of gas. For this there is good reason. This year the capital account will be swelled by the cost of the new works, on account of which £5364 has already been paid; and the charges for sinking fund and interest will be larger. There is, however, elasticity in the business. That is all that is required; and with the same careful management, there is every reason to expect that the Commission will enter upon the possession of their new works at Friarton stronger financially, as they certainly will be more fit in the matter of equipment, to meet the demand for gas.

The Corporation of Aberdeen have lodged in the House of Commons a petition against the Bill of the Great North of Scotland Railway Company, the inquiry into which by the Parliamentary Committee may be expected to be taken this month. It is a pity that a subject which is so eminently fitted for settlement should be the occasion of the spending of so much time and money. What divides the parties is money—not a matter of necessity, nor even of convenience. There is abundance of land in and around Aberdeen upon which gas-works and railway sidings might be constructed; and while it is true that a railway company should not obtain advantages which would be prejudicial to the interests of the community, it is equally true that giving a railway company facilities for the conducting of their traffic is one of the best means for promoting the good of a town. I sympathize with Mr. Smith's desire not to have his works broken in upon. The works are Mr. Smith's own creation. They do credit to him; and he may well be proud of them. I may say that I have not seen the like of them anywhere, either for design, construction, or maintenance. They contain everything which is to be found in a modern gas-works, down even to a cyanide plant, which is saying a great deal. It would be a pity to cripple an undertaking which is in such excellent order. But would it cripple it to take away a store-house in one corner? I see in the petition it is said that the portion of the site which it is proposed to take is an integral part of the works. It can scarcely be said to be so at present; but, of course, it may be included in the design, which is doubtless in existence, showing the works as they will be when the site is fully filled up. But this design could be altered; and I do not believe Mr. Smith would stand in the way of a public improvement unless he were convinced that it was his duty to do so. I fear, however, that it is not so much he that is the cause of the opposition as the Town Council Committee, who are desirous of effecting town improvements at the expense of the Railway Company. It is there where I disagree with them. I am with the Town Council, however, in the last part of their petition, where they ask to be indemnified for the cost of alterations which they may have to make in mains and sewers, in consequence of the railway operations. This is so obvious a burden on the Railway Company, that it is surprising it is not part of the Bill.

The Forfar Gas Corporation have this week been discussing another complaint made in regard to the conduct of the Gas Manager (Mr. Forbes Waddell). It arose in connection with the coal contracts. Regarding these, Bailie Patullo, who is now Convener of the Works Committee, stated that since the offers had been received the price of coal had fallen; and he suggested that they should re-advertise for tenders. This was agreed to. Then Mr. Craik began by saying that last time the offers were required to be in by May 12, but that he found a letter from the Cowdenbeath Company, dated May 13, to the effect that they confirmed an offer made by telegram that day. He wanted to know whether a telegram was sent to Cowdenbeath on the 13th, asking the Company to offer. Cowdenbeath was upon the list of those recommended; and he wished to know why the Company should be asked to offer. Well, to begin with, there is no Cowdenbeath Company; it is the Fife Coal Company, of Cowdenbeath. There are ways and ways of doing a thing; and Mr. Craik's way of doing this was that of the insinuator—that there was something underhand in the business. Mr. Craik was within his rights in asking an explanation of the matter; but I daresay it was not altogether an explanation which he wanted. The explanation of the incident—given after a great deal of heated wrangling had taken place—was that on the morning of the 13th a telegram came from Cowdenbeath, asking when the period for receiving offers expired; and the Manager replied that the offers were to be opened that day. The offer came in reply to this intimation, by telegram, followed by letter, which, I suppose, would not be delivered in Forfar till the 14th. The Clerk and the Convener opened the tenders before the receipt of the telegraphic offer, and counted 25 offers; but they did not look at them, nor make a list. The receipt of the letter from Cowdenbeath made 26 tenders. I have no doubt that the telegraphic offer, and perhaps the letter, too, was addressed to Mr. Waddell. That is, to me, the principal irregularity in the matter. But it is an irregularity on the part of the tenderers, and not on that of the Gas Manager; and to hold him responsible for it, is of the nature of oppression. Mr. Waddell further explained that offers had been accepted many a time which came in after the last day for receiving tenders, to which Mr. Craik replied that it never happened to his knowledge. I do not know the practice with reference to late offers; but I imagine it varies according to circumstances. Suppose a manager had an offer made to him the day after, which was cheaper than any that had been received, and was otherwise satisfactory, I think he would be within his right in accepting it—always granted that he had not done anything to promote it. There is, however, this to be said against doing so—that the late offerer might that morning, for instance, have ascertained from the representative of one who had tendered in time, the price which he had quoted (the information being given in the belief that it was now too late to tender); and he might then have wired off that he would supply coal at so much less. This, again, would not be the fault of the Manager, though it is a situation he ought almost to have in his mind in accepting a late tender. Were a manager, after seeing the tenders, to communicate them to other merchants, with a view to procuring lower offers, I could not justify him. I do not impute such conduct to Mr. Waddell, because I am satisfied that if he had done anything of the sort it would assuredly have formed part of the attack

GAS AND WATER COMPANIES STOCK AND SHARE LIST.

Referred to on p. 1373.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 15	10½	Alliance & Dublin 10 p. c.	23¼–24½	..	4 5 9
100,000	10	„	7½	Do. 7 p. c.	16–17	..	4 8 3
300,000	100	Jan. 3	5	Australian 5 p. c. Db.	107–109	..	4 11 9
200,000	5	May 26	6	Bombay, Ltd.	5¾–6	..	5 0 0
40,000	5	„	6	Do. New, £4 paid	4½–5	..	4 16 0
383,000	Stk.	Feb. 21	12	Brentford Consolidated	290–295	..	4 1 4
240,000	„	„	9	Do. New	215–220	..	4 1 10
50,000	„	„	5	Do. 5 p. c. Prf.	140–145	..	3 9 0
159,375	„	June 10	4	Do. 4 p. c. Db. Stk.	130–135*	−1½	2 19 3
220,000	Stk.	Mar. 30	11½	Brighton & Hove Orig.	270–275	..	4 3 8
218,820	„	„	8½	Do. A. Ord. Stk.	195–200	..	4 5 0
933,500	Stk.	Feb. 24	5	Bristol, 5 p. c. max.	127–132	..	3 15 9
420,000	20	Mar. 30	11½	British	55–56	..	4 0 4
50,000	10	Mar. 11	11½	Bromley, Ord. 10 p. c.	25–27	..	4 5 2
75,000	10	„	8½	Do. 7 p. c.	20–22	..	3 17 3
500,000	10	Apl. 29	6	Buenos Ayres (New) Ltd	9–9½	+½	6 6 4
98,122	Stk.	Dec. 30	4	Do. 4 p. c. Db. Stk.	98–100	..	4 0 0
150,000	20	Mar. 11	8½	Cagliari, Ltd.	30½–31½	..	5 4 9
100,000	10	June 10	7	Cape Town & Dis., Ltd.	15–16*	+¼	4 7 6
50,000	50	May 3	6	Do. 6 p. c. 1st Mort.	58–60	..	5 0 0
550,000	Stk.	Apl 15	13½	Commercial Old Stock	322–327	..	4 2 7
200,750	„	„	10½	Do. New do.	250–255	..	4 2 4
200,750	„	June 10	4½	Do. 4½ p. c. Db. do.	148–153*	+¼	2 18 10
800,000	Stk.	June 10	12	Continental Union, Ltd.	210–215*	+3½	5 11 7
200,000	„	„	9	Do. 7 p. c. Prf.	195–200*	+2	4 10 0
51,600	Stk	Feb. 24	14	Croydon A 10 p. c.	310–315	..	4 8 11
168,400	„	„	11	Do. B 7 p. c.	255–265	..	4 3 0
535,000	Stk.	Feb. 24	5½	Crystal Palace Ord. 5 p. c.	125–130	..	4 0 9
60,000	„	„	5	Do. 5 p. c. Prf.	142–145	..	3 9 0
486,090	10	Jan. 27	11	European, Ltd.	23½–24½	..	4 9 9
354,060	10	„	11	Do. £7 10s. paid	17–18	..	4 11 9
5,922,110	Stk.	Feb. 10	12¾	Gaslight & Coke, A, Ord.	298–303	+1	4 4 3
100,000	„	„	4	Do. B, 4 p. c max.	118–123	..	3 5 1
665,000	„	„	10	Do. C, D, E, 10 p. c. Prf.	302–307	+2	3 5 2
30,000	„	„	5	Do. F, 5 p. c. Prf.	150–155	..	3 4 6
60,000	„	„	7½	Do. G, 7½ p. c. do.	220–225	..	3 6 8
1,300,000	„	„	7	Do. H, 7 p. c. max.	195–200	..	3 10 0
463,000	„	„	10	Do. J, 10 p. c. Prf.	330–335	..	3 5 7
476,000	„	„	6	Do. K, 6 p. c. Prf.	182–187	+4	3 4 2
1,061,150	„	June 10	4	Do. 4 p. c. Db. Stk.	130–133*	..	3 0 2
294,850	„	„	4½	Do. 4½ p. c. do.	148–153*	+½	2 18 10
958,000	„	„	6	Do. 6 p. c. do.	198–203*	+1	2 19 1
70,000	10	May 12	8	Hongkong & China, Ltd.	13½–14½	..	5 10 4
3,800,000	Stk.	„	10	Imperial Continental	210–215	..	4 13 0
376,400	100	Feb. 1	4	Do. 4 p. c. Dbs. Red.	98–101	..	3 19 3
473,600	Stk.	Feb. 10	3½	Do. 3½ p. c. Db. Stk.	103–106	..	3 6 0
569,000	100	Apl. 1	5	Met. of Melbourne 5 p. c. Db.	110–112	..	4 9 3
250,000	100	„	4½	Met. of Melbourne 4½ p. c. Db.	107–109	..	4 2 7

* Ex div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
75,000	5	Dec. 15	6	Malta & Medn., Ltd.	5¼–5⅝	..	5 4 4
541,920	20	June 10	5	Monte Video, Ltd.	14–15*	..	6 13 4
617,946	Stk.	Feb. 24	9½	Newc'tle & Gatesh'd Con.	235–240	..	4 1 3
252,355	Stk.	Jan. 3	3½	Do. 3½ p. c. Db. Stk.	115–120	..	2 18 4
150,000	5	May 26	8	Oriental, Ltd.	7½–8	..	5 0 0
135,000	5	„	8	Do. New, £4 10s. pd.	6½–7	..	5 2 11
15,000	5	„	8	Do. do. 1879, £1 pd.	1¼–1⅝	..	4 11 5
60,000	5	Mar. 11	7	Ottoman, Ltd.	4¾–5¼	..	6 13 4
500,000	100	June 1	6	People's Gas of Chicago 2nd M. Bd.	103–108	..	5 11 1
848,070	10	May 26	6	River Plate Ord.	9–9½	..	6 6 4
250,000	Stk.	Jan. 27	4	Do. 4 p. c. Db. Stk.	98–100	..	4 0 0
250,000	10	Apl. 29	10	San Paulo, Ltd.	15–16	..	6 5 0
135,000	Stk.	Mar. 30	10	Sheffield A.	245–248	..	4 0 8
209,053	„	„	10	Do. B.	245–248	..	4 0 8
447,427	„	„	10	Do. C.	245–248	..	4 0 8
5,531,250	Stk.	Feb. 24	5½	South Metrop., 4 p.c Ord	138–141	+2	3 14 6
1,460,000	„	Jan. 13	3	Do. 3 p. c. Db. Stk.	101–104	+1	2 17 8
60,000	Stk.	Mar. 11	12	Tottenham and Edmonton A. B.	285–295	..	4 1 4
60,000	„	„	9		205–215	..	4 3 9
182,980	10	June 10	7	Tuscan, Ltd.	13–14*	+½	5 0 0
149,900	10	Jan. 3	5	Do. 5 p. c. Dbs. Red.	100–103	..	4 17 1
				WATER COMPANIES.			
746,164	Stk.	Dec. 30	10½	Chelsea, Ord.	320–325	−2½	3 4 7
150,000	„	„	5	Do. 5 p. c. Prf.	172–177	+2	2 16 6
160,000	„	„	4½	Do. 4½ p.c. Pf. Stk., 1875	150–155	..	2 18 1
175,785	„	Mar. 30	4½	Do. 4½ p. c. 1 b. Stk.	157–162	..	2 15 7
1,720,560	Stk.	Apl. 15	8	East London, Ord.	225–230	..	3 9 7
654,740	„	Dec. 30	4½	Do. 4½ p. c. Db. Stk.	158–162	..	2 15 7
390,000	„	„	3	Do. 3 p. c. Db. Stk.	104–106	..	2 16 7
700,000	50	Dec. 15	7½	G'd Junct'n, 10 p. c. max.	115–120	..	3 2 6
310,000	Stk.	Mar. 30	4	Do. 4 p. c. Db. Stk.	140–145	..	2 15 2
708,000	Stk.	Feb. 10	13	Kent	358–363	..	3 11 8
160,000	„	„	7	Do. New, 7 p. c. max.	218–218	..	3 4 3
1,043,800	100	Dec. 30	10	Lambeth, 10 p. c. max.	295–300	..	3 6 8
406,200	100	„	7½	Do. 7½ p. c. max.	228–233	..	3 4 4
850,000	Stk.	Mar. 30	4	Do. 4 p. c. Db. Stk.	140–145	..	2 15 2
500,000	100	Feb. 10	13	New River, New Shares	432–437	+2	2 19 6
1,000,000	Stk.	Jan. 27	4	Do. 4 p. c. Db. Stk.	141–146	..	2 14 10
902,300	Stk.	Dec. 15	6	Southw'k & V'xhall, Ord.	160–165	+5	3 12 9
126,500	100	„	6	Do. do. 7½ p. c. max.	152–157	..	3 16 5
489,200	Stk.	„	5	Do. do. 5 p. c. Prf.	170–175	..	2 17 2
1,019,585	„	Apl. 15	4	Do. 4 p. c. A Db. Stk.	140–143	..	2 15 11
1,155,066	Stk.	June 10	10	West Middlesex	295–300*	..	3 6 8
200,000	„	„	4½	Do. 4½ p. c. Db. Stk.	160–163*	+1½	2 15 3
200,000	„	Mar. 11	3	Do. 3 p. c. Db. Stk.	104–106	..	2 16 7

* Ex div.

upon him; and it did not. The new tenders are to be opened in presence of the Committee; and no offers are to be accepted unless they are in time. Strictly speaking, this is the right way; always remembering that a tender which is posted anywhere within the United Kingdon before midnight of the last day is acceptable, the doctrine being that when it has been handed to the post office it is beyond recall or alteration by the tenderer. But, after all, it is a pity that members of a public body like the Forfar Gas Corporation should be so full of mistrust of each other. There can be no *esprit de corps* where such a feeling exists as there is here; and, what is worse, there is nothing which paralyzes officials more in the doing of their work than lack of confidence in them—and that all the more so when it happens to be undeserved.

The recently-reconstructed Earlston Gas Company have paid a dividend for the year at the rate of 10 per cent., and have reduced the price of gas from 6s. 8d. to 5s. 10d. per 1000 cubic feet. All their coal comes over the North British Railway; and the Gas Company and the community are of opinion that the Railway Company might reciprocate and light their station premises by gas instead of oil. A petition to this effect was presented to the Railway Company, but has been refused, on account of the high price charged for gas. This is surely lack of enterprise. The Railway Company cannot but know that the way to get cheaper gas is for more people to use it; and that, if more gas were required, there would be more coal to be carried to Earlston, with the result that their revenue would benefit.

The Birnam Gas Company have paid a dividend at the rate of 3 per cent. The Leven (Fifeshire) Gaslight Company have declared a dividend at the rate of 7½ per cent. Last year the dividend was 10 per cent.; but since then the capital of the Company has been doubled. The Largs Gas Company have paid a dividend at the rate of 6 per cent.

Last night a public meeting was held in the open air at Monifieth, at which a resolution was adopted protesting against the proposal of the newly-formed Gas Company to erect their works on what was described as the only bit of green that had been preserved in the centre of the burgh. The complaint is not only that the gas-works will be an eyesore, but that, after the community, by a vote which cost the small place £47, rejected the adoption of the Burghs Gas Supply Act, the Provost and other Police Commissioners should attempt to put down a gas-works at all. Meantime the Directors are proceeding with the work of building up the Company. This week they allocated the shares, which, it is announced, were over-applied for—a circumstance which shows that there are some in or around Monifieth who think the place ought to be lighted by gas.

The Edinburgh and District Water Trust and the Clippens Oil Company, Limited, who have been not only litigating but legislating over the question of the possession of minerals under the pipe-track of the Trust, have come into grips which are closer than ever. This week the record has been closed in the Court of Session in an action brought by the Oil Company against the Water Trust, in which they sue for £137,000 as damages which they say they have sustained in consequence of having to close their works when the Trust obtained interdict against them, in March, 1897. The Trust say the capital of the Company is £126,000, of which £91,959 has been called up; and they aver that it was not necessary for the Company to close their works, as they had abundance of shale and limestone, in places to which the interdict did not apply, which they could have worked. They also assert that the shale below the pipe-track consisted of small stoops, and that it could have been worked at a profit. An action by the Trust against the Oil Company was continued for a week.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June* 11.

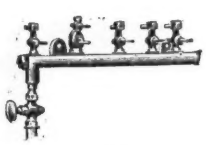
Sulphate of Ammonia.—There has been a quiet market with some decline in values; to-day's quotations being £9 2s. 6d. per ton f.o.b. Hull and Leith; and about £9 5s. per ton f.o.b. Liverpool. Requirements for the autumn season are not yet urgent; and consumers are kept quiet by speculative quotations at below spot values. Second-hand parcels, too, have been rather freely offered, apparently with the object of depressing prices; and Scotch makers, whose production is not much reduced during the summer months, have exhibited a disposition to sell as their output becomes available. Elsewhere there are no stocks; and, production being small, a very moderate quantity has been offered. Even in Scotland, it must be remembered, a fair proportion of the production had been placed in advance. In the forward position, there is not much doing; but £9 5s. per ton f.o.b. Leith is probably the nearest value for delivery over the autumn months.

Nitrate of Soda is firm in all positions; and 7s. 9d. per cwt. is the quotation for fine quality on spot. The altogether unprecedented consumption January-May—720,000 tons United Kingdom and Continent—has left its mark upon the visible supply at the end of May; the then visible supply (stocks and afloat) being only 225,000 tons, against 305,000 tons at the end of May, 1896. Stocks in Europe at the end of May were only 50,000 tons, against 135,000 tons this time last year, and 95,000 tons at the end of May, 1896. These figures amply justify present prices, and even a higher range—especially in view of high freights, and the continued weeding out of the weakest and least favourably placed producers.

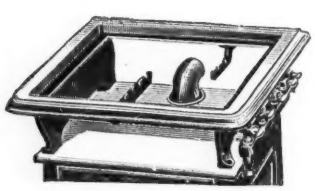
LONDON, *June* 11.

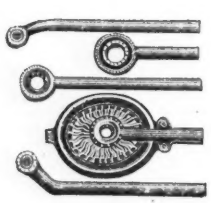
Tar Products.—The flatness noticed last week in benzols has brought lower prices, and caused shyness in buyers. A good deal of 90 per cent. benzol, however, is being used for gas enrichment—indeed, if it were not for this outlet, the market would be in a sorry plight. A little more firmness is noticeable in the value of pitch for next season's delivery; while spot parcels are realizing better prices. The shipping season is practically at an end; and makers are not much interested in recent sales—transactions being mostly in second-hand stuff. Creosote is steady, with a fair outlet for production. Carbolic acid is also inquired for; but there is no improvement in price. Anthracene shows no interesting feature; but Committee prices remain firm, while odd outside makes, especially of inferior quality, can be procured at low rates.

Average quotations for the week are: Tar, 11s. 6d. to 15s.; pitch, 22s. east coast; 18s. 6d. west coast. Benzols, 90's, 10½d.; 50's, 1s. Toluol,



DETACHABLE GAS BAR.





POPULAR PROVERB:

"Imitation is the sincerest form,"

&c., &c.

RICHMOND & CO., LTD.

LONDON, WARRINGTON, & STRATFORD.

INVENTORS

HOT PLATE

AND

OVEN

LOOSE BURNERS.

These features have made the growth of our business a record in the Gas Industry of the World.

BELIEVE US, THERE ARE NO DISADVANTAGES.

See Eminent Engineers' Testimonials.

90's, 1s. 3d.; pure, 2s. Solvent naphtha, 1s. 2½d. Heavy naphtha, 1s. 2d. Crude, 30 per cent., naphtha, 4½d. Creosote, 2¾d. Heavy oils, 50s. Carbolic acid, 60's, 2s. Naphthalene, 50s.; salts, 32s. 6d. Anthracene, "A," 4¾d.; "B," 3d. to 4d.

Sulphate of Ammonia is somewhat neglected; and lower prices have obtained. There is no important business transacting; and the lots that have changed hands during the week have been mostly between dealers. Manufacturers are firm in their ideas of value; and it remains to be seen whether they will lend themselves to the "bear" operations now going on. Quotations are nominally £9 2s. 6d., less 3½ per cent. in all positions.

COAL TRADE REPORTS.

From Our Own Correspondents

Lancashire Coal Trade.—The coal trade of this district maintains an exceptionally steady position for the time of the year. The lower qualities of round coal are in active demand, for ironmaking, steam, and general manufacturing purposes; and inland pit prices are firm at about 6s. 6d. to 7s. per ton. Engine fuel is also steady at late rates—common sorts averaging 3s. 3d. to 3s. 6d. per ton; medium, 3s. 9d. to 4s. 3d., and best sorts, 4s. 6d. to 4s. 9d. In the shipping trade, there is a brisk inquiry for steam coal; and with the unexpected prolongation of the South Wales dispute, prices are being kept up at an advance of 9d. to 1s. per ton over those ruling prior to the strike—steam coal, delivered at the Mersey ports, ranging from 8s. 6d. to 9s. 6d. per ton. The strike is also bringing an increased weight of business to the Manchester Ship Canal, especially to the Partington tips; and it is anticipated that a considerable weight of trade may be permanently diverted to the Ship Canal for markets hitherto exclusively supplied by Welsh collieries. With regard to forward contracts, it seems certain that the railway companies will not be able to settle renewals for locomotive fuel within at least 6d. to 9d. per ton of last year's prices, though the negotiations which have been going on recently have not yet been brought to any definite conclusion. As to gas coal, the reports which were current that large contracts have been placed in Westphalia, though they necessarily have a somewhat unsettling effect with regard to the advance for which colliery proprietors are holding out, scarcely obtain full credence in the market. So far contracts have only been settled to a very limited extent; but generally representatives of Lancashire collieries state that they have been able to secure advances of quite 6d. per ton over last year's low rates. In some quarters there are, however, considerable doubts whether even this small advance will be fully maintained as the season goes on; and opinions have been freely expressed that not a few colliery owners will be content to accept contracts even if they are unable to get an advance of more than 3d. per ton. The determined attitude that has been taken up by the Miners' Federation on the wages question is, however, an important factor in determining prices.

Northern Coal Trade.—The coal trade of this district has been active in all its branches in the last few days. Best Northumbrian steam coals are from 12s. 6d. to 13s. per ton f.o.b.; and steam smalls vary from 4s. 9d. to 5s. In the gas-coal trade, the demand is good for the season; and about 8s. to 8s. 6d. per ton is the f.o.b. quotation for best coals for forward delivery. The bulk of the Metropolitan coal contracts have been concluded at 10s. 8d. and 10s. 10d. per ton delivered; though for one gas-coal supply from a pit of very high quality, about 11s. 3d. per ton has been fixed. If from these prices about 3s. 3d. per ton be deducted for the freight to the Thames, something like an idea of the f.o.b. price will be arrived at. Negotiations are now proceeding for the gas coal for Newcastle. Manufacturing coals are steady, with a good demand. Gas coke is firmer in price; the output less, and stocks limited—especially with companies whose position enables them to export their produce.

Scotch Coal Trade.—The coal market seems to be steadying down into the regular summer business. The output is large; but there is as yet demand for all that is being brought to the surface. The prices quoted are: Main, 8s. per ton f.o.b. Glasgow; ell, 8s 6d. to 8s. 9d.; and splint, 8s. to 8s. 6d. The shipments for the week amounted to 220,317 tons—an increase of 3129 tons upon the preceding week, and of 72,295 tons upon the corresponding week of last year. For the year to date, the total shipments have been 3,623,439 tons—an increase upon the same period of last year of 539,907 tons.

Ramsgate Corporation Gas and Water Supply.—The net profit realized by the gas undertaking of the Ramsgate Corporation in the past financial year was £1779; and by the water undertaking, £494. The total amounts furnished by the gas and water works, which are under the supervision of Mr. W. A. Valon, in relief of the rates up to the end of the year were £30,159 and £4996 respectively—together, £35,155.

Neath Corporation Gas Supply.—The Manager of the Neath Corporation Gas-Works (Mr. R. A. Browning) has presented his annual report to the Gas Committee; and, as in the case of many other gas undertakings, it discloses a small diminution in profit. The total was £2646, which was about £350 less than in the previous year. Owing to the exceptional mildness of last winter, the increase in the consumption of gas was not so great as formerly. In the gas world this has been a general complaint; and it points out that the climatic changes play an important part in the fortunes of a gas undertaking more especially now than formerly, as gas is so largely used for cooking and heating purposes. The expenditure amounted to £7593, which was an increase of about £624; and the receipts totalled to £10,239, which was an increase of about £280. The balance of net profit was appropriated as follows: After paying £866 interest on the different loans and £51 at bank, £110 has been carried to the depreciation fund account, which now stands at £500, and repayment of principal account receives £1250—leaving the substantial balance of £4233 to be carried to the next account. As to the working results, the make of gas per ton of coal carbonized showed an increase. No cannel or any other enricher was used with the ordinary coal; and yet the average illuminating power of the gas supplied was 15¾ candles—1¾ candles above the parliamentary requirements. The number of consumers has increased by 10 per cent.

R. & A. MAIN, Ltd.

Argyle Works, GLASGOW.

Telegrams: "GASMAIN, GLASGOW."

109, Farringdon Road, LONDON, E.C.

Telegrams: "GASMAIN, LONDON."

BRISTOL:
28, BATH STREET.
Telegraphic Address: "GOTHIC."

BIRMINGHAM:
1, OOZELLS STREET.
Telegraphic Address: "GOTHIC."

MANCHESTER:
37, BLACKFRIARS STREET.
Telegraphic Address: "GOTHIC."

THE

"MAIN" COOKER

With removable Enamelled Fittings.

Inside Linings can be had Enamelled in a variety of shades.

WRITE FOR OUR NEW SEASON'S LIST.

Assessment of the Blyth and Cowpen Gas-Works.—On Thursday, the Blyth and Cowpen Gas Company appeared before the Assessment Committee of the Tynemouth Union to object to the assessment of their undertaking, which had been raised to £1460. A settlement was eventually arranged at £1025. Mr. Newbigging appeared for the Company.

Stourbridge Gas Supply.—The report of the Gas Committee for the year ending March 31, presented at the meeting of the Stourbridge Urban District Council last Wednesday, shows that the sales of gas were 119,128,100 cubic feet, or 12,914,100 cubic feet more than in the previous year—being an increase of 12½ per cent.; while the money increase on gas sold was £1744. Out of this the prepayment meters accounted for 3,989,100 cubic feet of the increase. The market for residuals was low during the year; and this left the surplus profit less than could have been wished. There was nevertheless a balance of about £800.

Reductions in Price.—The Directors of the Clayton, Allerton, and Thornton Gas Company have decided to reduce the price of gas to 2s. 6d. per 1000 cubic feet net on and after the 1st prox. The present price is 3s. 4d., less 5d., if paid within six weeks from the date of the account. The reduction, which will represent about £1000 per quarter, is therefore one of 5d.; and the discount system is abolished. The Gas and Electric Lighting Committee of the Darwen Town Council have decided to recommend that the price of gas for all purposes be reduced to 2s. 6d. per 1000 cubic feet as from July 1 next. This is a concession of 3d.

The Halifax Gas Committee and the Workmen's Compensation Act.—The Gas Committee of the Halifax Corporation, we understand, have decided to form a fund of their own to meet any claims for compensation that may arise under the Workmen's Compensation Act. They propose to set aside an amount equal to 1 per cent. of the total wages paid for this purpose. During the past two years, only £25 has had to be paid by the Committee by way of compensation to workpeople; and the works are now so equipped that the liability to accident is considered to be reduced to a minimum. The premiums asked by the Insurance Companies consulted amounted to double the percentage proposed to be set aside by the Committee.

Tonbridge Water Company.—At the recent annual meeting of this Company, the Chairman (Mr. J. Fagg), in moving the adoption of the Directors' report, said the past year had been an anxious time for them and their Manager, Mr. J. Lees; but, though the outlay had been considerable, it was absolutely necessary, to meet the increasing demands for water. The new reservoir was in every way most satisfactory; and the anticipations of the Directors as to the augmented yield of water had been fully realized. They were able to recommend a higher dividend by paying 9 per cent. on the original, and 6¼ per cent. on the additional shares. The Company have arranged to supply Southborough with a portion of their water as soon as the necessary connections could be made. A vote of thanks having been accorded to the Directors, the Chairman proposed a similar vote to Mr. Lees, who, he said, had so successfully carried out his work. The proposition was heartily supported. Mr. Lees, in responding, expressed his conviction that great possibilities were before the Company in the near future; but there were also great responsibilities, which he had no doubt would be satisfactorily dealt with.

The Boring for Coal in East Anglia.—The attempt to find coal in East Anglia has been given up at last; the Eastern Counties Coal Boring and Development Company having decided to suspend operations, and go into voluntary liquidation. The result will probably be an end to boring for coal in East Anglia for another generation.

Increased Assessment of the Leeds Corporation Water-Mains.—The Water Committee of the Leeds Corporation last Friday decided to appeal against what they considered to be the exorbitant figure at which the Bramley Authorities have assessed the water-mains running through that township. The Committee are of opinion that a just assessment would be £1900; while the Bramley Authorities have put the figure at £3297. The Holbeck and Hunslet Unions have also increased the assessment of the mains running through their respective districts. But in these cases the Committee are prepared to pay—believing the advances are not out of proportion to the growing value of the property in these particular localities.

Sheffield Corporation Water Accounts.—In last week's issue, we gave the principal portions of the annual report of the General Manager of the Sheffield Corporation Water Department (Mr. W. Terry). In presenting it at last Wednesday's meeting of the City Council, Alderman Gainsford said, although it was satisfactory, he regarded it as simply the result of the normal progress of the city; and the Water Committee had no more to do with the result than experiencing the gratification of presenting a report of such a pleasing nature. From Dec. 25 last, £11,000 had been taken off the water charges, in the shape of remission of the half of the 25 per cent. of which they had heard so much; and £11,000 a year was equal to 2½d. in the pound on the district rate. It was as much money in the pocket as if the district rate had been reduced by that amount. He knew that the water consumers and the ratepayers were not absolutely identical; but they were so to all practical intents and purposes. He thought they might safely draw the conclusion that the other half of the 25 per cent. would be very shortly remitted, and that there would be another 2½d. in the pound to be put to their credit. But when they had remitted the whole of the 25 per cent., they might look forward to possessing in the water undertaking a very valuable income-earning property which would give to the credit of the Corporation in future years a very valuable source of revenue. Alderman Sir Charles Skelton congratulated the Committee on finding themselves in such a comfortable position. Alderman Carter said in his opinion there was an important matter which required consideration before any further reduction took place in the rates, and that was the condition of the water itself. On the previous Monday, at the Glossop Road swimming bath, even at the shallow end, it was absolutely impossible to see the bottom, though the bath was lined with glazed white bricks. When the bath was emptied of water, a thick layer of brown coloured matter, of a peaty substance, covered the bottom. As soon as the Committee were in a position to do it, they should undertake a filtration scheme. One or two other members confirmed the last speaker's remarks as to the condition of the water; and Alderman Gainsford asked Alderman Carter to bring the question of the filtration of the water before the Committee. The report was adopted.

JOSEPH AIRD
GREAT-BRIDGE,
STAFFORDSHIRE.
HIGHEST QUALITY
TUBES AND FITTINGS
GAS, STEAM, WATER, GALVANIZED TUBES and FITTINGS in all Sizes.
LARGE TUBES FOR COLLIERIES.
Illustrated Price Lists on Application.
LONDON OFFICES: 46, QUEEN VICTORIA STREET, E.C.

A Simple Method of Settling an Assessment Dispute.—In consequence of a considerable increase in the assessment of the Hull Water-Works by the Sculcoates Board of Guardians, the Corporation Water Committee decided to appeal. In order, however, to avoid litigation and the inevitable heavy cost of such proceedings, a very sensible arrangement has been arrived at between the two bodies, whereby the whole question of the rating of the works is to be submitted to Mr. W. H. Wellsted, whose decision is to be final.

Annual Meeting of the North Shields Water Company: The Purchase Question.—At the annual meeting of this Company, last Thursday, the Directors reported that the revenue for the year showed an increase of £880. The gross revenue was £12,477; and the expenditure (including a sum paid to the Newcastle and Gateshead Water Company, and the interest on loans), £10,001—leaving a balance of £2476. The Right Hon. Earl Percy's one-seventh share of the clear annual profits amounted to £558, and, deducting this from the profits, £1918 remained to be added to the balance at credit of the profit and loss account. The delay that had arisen in the matter of the arbitration for the transfer of the works under the Tynemouth Corporation (Water) Act, 1897, had rendered it necessary that the Company should continue to fulfil their obligations for another year; and a sum had been expended on capital account amounting to £1504 to meet the increased requirements of the district. The balance at credit of the revenue account had been utilized for this purpose, instead of borrowing money. The Directors, therefore, did not recommend the payment of a dividend, reserving the amount for the final settlement under the arbitration. It was expected that the reference to arbitration would be heard within six months of the passing of the Act. But after the appointment of Sir Douglas Galton as sole Arbitrator, an extension of time was agreed to by all parties. In moving the adoption of the report, the Chairman (Mr. Seymour Bell) announced that the arbitration had been definitely fixed for July 25. In the Tynemouth Water Act, the capital of the Company was stated to be £60,000, and £37,297 was owing on mortgage of the undertaking—a total of £97,297. There was no provision in the Act for this being increased, either for carrying on the works, extensions, or for any other purpose. This placed the Company in the awkward predicament of being in possession of a rapidly increasing district, and with no means of extending their operations, to keep pace with the requirements. He would be very much surprised if the Company lost anything by its act of self-denial.

The Economical Gas Apparatus Construction Company, Limited, have obtained the contract to supply a complete installation of carburetted water-gas plant to the York United Gas Company. They have also been entrusted with the supervision of the erection of a holder, oil-storage tank, and other plant.

Messrs. J. Taylor and Co., of Bolton, have recently received orders for their latest make of solid-plate lead saturators for the Mitcham and Wimbledon District Gas Company, the Gas Departments of the Coventry and Chorley Corporations, and the Ambleside and Uttoxeter Gas-Works. These saturators are similar to those which the firm have lately supplied to the Croydon and Kingston-on-Thames Gas Companies.

The Board of Trade have received, through the Foreign Office, a dispatch from Her Majesty's Consul-General at Christiania, stating that the whole of the amendments made in the Customs tariff of Norway came into force on the 1st inst. The most important alteration is the imposition of a duty on machinery. Motors for steam, water, wind, gas, petroleum, benzene, and electricity, dynamos, and parts of the same, will pay 5 per cent. minimum and 10 per cent. maximum.

Exhibitions of gas appliances have lately been held by the following firms: Messrs. Fletcher, Russell, and Co., Limited (in conjunction with Messrs. C. Wilson and Sons), at Ripon, with demonstrations by Mrs. H. M. Young; Messrs. W. Parkinson and Co., at Oswestry, with lectures by Miss E. Sanderson; and at Newton Heath, with lectures by Miss E. A. Smith. Messrs. Richmond and Co., Limited, at Ballina, Bungay, Edinburgh, and Prescot, with lectures by Mrs. Bradshaw, Miss Richmond, and Miss Smallwood.

On Monday last week, an exhibition of the Welsbach Company's new burner was opened in the Park Hall, Cardiff, and continued till Wednesday, on which day a similar exhibition was opened at the Free Trade Hall, Manchester. In connection with the latter, a large number of representative gentlemen (including Mr. C. Nickson, the Superintendent of the Gas Department of the Corporation) were entertained at luncheon at the Grand Hotel on Thursday—Sir Henry Burdett, K.C.B., the Chairman of the Welsbach Company, presiding.

Holophane, Limited, are introducing a new pattern of their light-diffusing globes specially adapted for street-lighting purposes. A very beautiful effect is obtained by the use of these globes in public lamps; and an illustration of what may be achieved by their adoption may be seen in the city of Munich, where they have been applied to no less than 4900 lamps. The high opinion held by the Lighting Engineer of the city (Mr. Uppenboon) as to their value is found in these words: "We may now justly be satisfied with our street lighting."

Visitors to the exhibition of the Welsbach Company's new burner at Niagara will doubtless recollect that in a separate apartment they were afforded an opportunity of witnessing (by the aid of dark glasses) the effect produced by a new illuminating agent, to which the name of Hydro-Press Gas has been given, when employed with incandescent burners. The intense brilliancy of the light left upon the eyes of the beholders an impression which was not quickly removed. As already announced (*ante*, p. 1337), a Company has been formed to work the patent, under a contract with the Welsbach Company; and a display of the system was given last Thursday at the Mechanics' Institute, Bradford. The chief feature of the invention was the "hydro press," wherein, by the action of falling jets of water, the pressure of the gas is increased up to 40 inches. The burner does not differ materially from the old type, except that the gas is admitted in a fine stream under pressure at the base of an expanded air-tube. The mantle, which is used without a chimney, is of coarser and stronger material than the ordinary Welsbach. The promoters claim that, including the cost of water and gas, they can give a light of 740-candle power for an hour for 1d., as against 300-candle power at the same cost for an arc light. The apparatus shown on Thursday was stated to be using 110 gallons of water per hour, for 2000-candle power.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

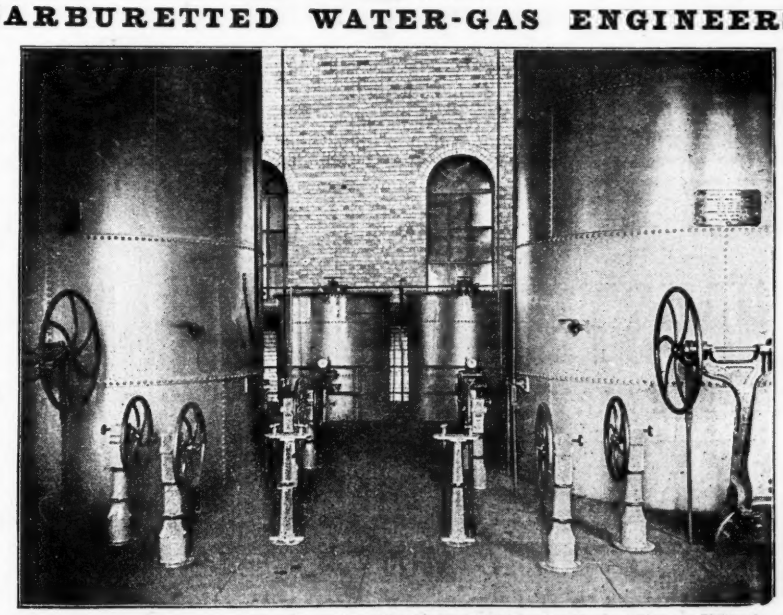
The Economical Gas Apparatus Construction Co., Ld.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
American Offices: TORONTO. TELEGRAPHIC ADDRESS: "CARBURETED, LONDON."

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, M.E., Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

CARBURETTED WATER-GAS ENGINEERS.

THE M.-W.-P. PLANT is designed to use the Heaviest as well as the Lightest Grade of Oil.



RESULTS PROVE EFFICIENCY.

Working Floor of Generator House. One Quarter Section of Birmingham Plant, Windsor Street Station.
The Maximum Daily Capacity of the Birmingham Corporation's Plant, which was erected by this Company, is 10 MILLION CUBIC FEET.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.

JOHN WM. O'NEILL, Managing Director,
160, 161, & 162, PALMERSTON BUILDINGS,
OLD BROAD STREET,
LONDON, E.C.

ANDREW STEPHENSON, AGENT. All communications *re* Oxide to the Company as above.

WINKELMANN'S "VOLCANIC" and "VOLCUM" CEMENT. Fire Resistance up to 4500° Fahr. In use in Gas-Works all over the World.

ANDREW STEPHENSON,
182, PALMERSTON BUILDINGS,
OLD BROAD STREET,
LONDON, E.C.

Telegrams: "*Volcanism, London.*"

BROTHERTON & CO.

Offices: Commercial Buildings, LEEDS. Correspondence invited.

TUBES for Gas, Steam, and Water (all Sizes) Welded or Riveted. TANKS, HYDRAULIC MAINS, RETORT-LIDS, &c.

JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See p. 1290, last week's issue.)

Telegrams: "HUTCHINSON BROS., BARNSLEY."

AMMONIACAL LIQUOR wanted.

BROTHERTON AND CO., Ammonia Distillers. Works: BIRMINGHAM, LEEDS and WAKEFIELD.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E., and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE. Information and Handbook on application.

70, CHANCERY LANE, LONDON, W.C.

GAS TAR wanted.

BROTHERTON AND CO., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special attention to Repairs.

Before placing Orders, please write for Estimate.

Telegraphic Address: "SATURATORS, BOLTON."

SPENT OXIDE wanted.

BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

LLEWELLYN JONES & T. B. YOUNGER, CONSULTING ENGINEERS, VALUERS, &c., CHESTERFIELD HOUSE, 98, GREAT TOWER STREET, E.C.

SADLER & CO., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making, Kerosene, &c.

Correspondence invited.

Telegraphic Address: "SADLER, MIDDLESBROUGH."

J. & J. BRADDOCK, Globe Meter Works, Oldham.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.

Telegraphic Address: "PORTER LINCOLN."

[For Illustrated Advertisement, see June 7, p. 1345.]

IMPORTANT.

OLD Retorts made equal to new by repairing them with CROWTHER'S PATENT STICKFAST FIRE CEMENT. Unequalled for Repairing Inclines. Can be used in Hot or Cold Retorts; and "A1." for Mouthpiece Joints. Satisfaction Guaranteed.

CROWTHER, Practical Retort Setter, Manor Street, HUDDERSFIELD.

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.

Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, or NEWTON GRANGE, NEWBATTLE, DALKEITH, SCOTLAND.

ENRICH YOUR GAS
WITH
CHEAP BENZOL.

AT to-day's Price of Benzol. Illuminating POWER cost less than a HALFPENNY PER CANDLE.

Apply to SADLER AND CO., MIDDLESBROUGH.

NEW GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO., VICTORIA PAINT WORKS, MANCHESTER.

For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

TO GAS AND WATER OFFICIALS.

SPECIALLY favourable terms for Cycles. First-Class Workmanship and Material guaranteed. Art Catalogue post free.

MELROSE CYCLE COMPANY, COVENTRY.

WATER-GAS PLANT.

ENGINEERS contemplating the above are invited to communicate with the Advertiser, who is prepared to give every assistance in designing Plant of any capacity.

J. L. FEATHERSTONE, 30, Amesbury Avenue, STREATHAM HILL.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.

Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.

READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.

120 and 121, NEWGATE STREET, LONDON, E.C.

Telegrams: "BOGORE, LONDON."

SULPHURIC ACID for Sale.

BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

ECONOMY IN PURIFICATION.

INCREASE the efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.

References and Particulars can be obtained from the Makers—

C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP.

PRELIMINARY NOTICE.

KEYS' AUTOMATIC METER REGISTER.

NOW in the Press, the Easiest, Simplest, and most complete BOOK FOR METER REGISTRATION that has been submitted to Gas Companies.

For further Particulars, apply to the Publisher, WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation in a Gas-Works by a thoroughly practical Man with 25 years' Experience in the business. Erection, Carbonizing, Distribution, &c. Age 40. Good References.

Address No. 3082, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SITUATION wanted by Advertiser, with 5½ Years' Experience, as CLERK in Gas Office or COLLECTOR of ACCOUNTS. Accustomed to Prepayment Meter System. Highest References. Age 25.

Address No. 3079, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, near Barnsley, a good FOREMAN, accustomed to erecting Gas-Works Plant. Good opening for suitable Man.

State Age and Wages required to Box 405, MANCHESTER.

WORKING Manager Wanted to take charge of Small Works and Plant in Country Place. Small Engine and Boiler. Make 1½ Millions; comfortable job. Good terms to suitable Man.

Apply to Mr. W. TAYLOR, Gas Engineer, Glossop, near MANCHESTER.

WANTED, good Retort Setters, used to Regenerator and Generator Furnaces. The highest Wages paid for good Men; no others need apply.

Messrs. TIMMIS AND CO., Gas Engineers, River Stour Fire-Clay Works, STOURBRIDGE.

WANTED, immediately, a Secretary and MANAGER for the Holmfirth Gas-Works. Make of Gas, 19 Millions.

Applications, stating Age and Salary required, with *copies* of recent Testimonials, and endorsed "Manager," to be sent by the 24th of June to the CHAIRMAN, Beech House HOLMFIRTH.

WANTED, by a long-established Firm, a thoroughly competent REPRESENTATIVE to extend Connection among Gas Engineers in London and District.

Apply, in confidence, stating Qualification and Salary required, to No. 3080, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GWYNNE & BEALE'S

PATENT

GAS-EXHAUSTERS AND STEAM-ENGINES

FOR FULL PARTICULARS, APPLY TO THE MAKERS:

GWYNNE & CO.,

Telegrams: "GWYNNEGRAM, LONDON."

HYDRAULIC AND GAS ENGINEERS

(Late Essex Street Works, Victoria Embankment, London),

Telephone No. 95 Holborn.

BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

SERVICE LAYER.

WANTED, immediately, a steady young Man as OUTDOOR SERVICE LAYER for a Gas Company in South Wales.
Apply, by letter, to No. 3081, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an Inside Manager for a Tar and Ammonia Works (Manchester District). State Qualification, Salary required, and other Particulars.
Address No. 3078, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Birstall Urban District Council, a thoroughly practical WORKING GAS and WATER MANAGER, at a combined Salary of £120 per annum, with House, Coal, Gas, Water, and Rates free. Age not to exceed 45 years.
Applications, endorsed "Manager," with *copies* of Two Testimonials of recent date, to be sent to me not later than the 18th of June.

WILLIAM MIDDLEBROOK, Solicitor,
Clerk to the Council.

Council Offices, Birstall,
Near Leeds, June 7, 1898.

GAS Engineer wanted immediately by the Pará (New) Gas Company, Limited. Must be a thoroughly experienced and practical Gas Engineer. Age not under 30. Salary £400 per annum, with Liberal Bonus on results, and House, Gas, and Coal free.
Applications, stating Age, Experience, Qualifications, &c., and with *copies* of not more than four recent Testimonials, to be addressed immediately to

J. A. PATTULLO,
Secretary.

Pará (New) Gas Company, Limited,
8, Hill Street, Edinburgh.

GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the BRIMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

WANTED, Carbon in 4 Ton Lots, or more.
State Price, f.o.r. at nearest Station, to No. 3081, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—A 7000 Feet per hour EXHAUSTER. May be seen at work.
Apply to the MANAGER, Gas-Works, MATLOCK BRIDGE.

FOR SALE—Four Purifiers, 7 feet square, 3 ft. 9 in. deep, with two sets of Grids, Covers, Lifting Gear, twelve 8-inch Valves and Connections, all complete.
Apply to the MANAGER, Gas-Works, ARDROSSAN.

FOR SALE, Cheap—The under- mentioned GAS PLANT:—
2 PURIFIERS, 5 ft. square by 4 ft. deep.
1 PURIFIER, 5 ft. square by 2 ft. 9 in. deep.
CONDENSER, 4 inches diameter, Vertical Pipes.
EXHAUSTER (Gwynne's), 20,000 c. f. per hour.
Apply to SAML. WHILE AND SONS, 60, QUEEN VICTORIA STREET, E.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. **Compare Prices and Particulars before ordering elsewhere.**
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

FOR SALE, owing to Extensions—Two PURIFIERS, 8 feet square, 5 feet deep, Grids, Covers, Lifting Gear, and Valves, all complete. Comparatively new; offers wanted.
Apply to the Gas-Works, Hoylake.

By order,
A. G. READDY,
Secretary.

Gas and Water Offices:
8, Filey Terrace, Hoylake, June 9, 1898.

TO TAR DISTILLERS.

OFFERS are invited for about 1300 Tons of TAR and 1250 Tons of AMMONIACAL LIQUOR.
Sealed and endorsed Tenders to be sent to F. C. Humphrys, Esq., Gas Engineer, Ilkeston.
Particulars and Form of Tender can be had on application to

JOHN ANDREWS,
Secretary, Derby and District
Residual Product Committee.

Gas-Works, Langley Mill.

MILLOM URBAN DISTRICT COUNCIL.

TENDERS are invited for the supply of from 1600 to 2000 Tons of GAS COAL at such times and in such quantities as the Council may require during Twelve Months from the 1st of July next. The Coal must be of the best quality. Full Particulars of Coal, Colliery, and Working Analysis to be given.
State Price per Ton delivered free at Millom Station, and (where applicable) at the nearest Port to Colliery or Depôt.
Sealed Tenders, on Forms (which can be had on application), endorsed "Tender for Coal," to be sent in to me not later than the 28th inst.
The Council will not be bound to accept the lowest or any Tender.

W. T. LAWRENCE,
Clerk.

Millom, June 2, 1898.

THE INCORPORATED

Gas Institute.

THE THIRTY-FIFTH

ANNUAL GENERAL MEETING

OF THE MEMBERS

WILL BE HELD ON

Tuesday, Wednesday, and Thursday,

the 21st, 22nd, and 23rd of June, 1898,

AT THE

EXHIBITION HALL,

BOTANIC GARDENS PARK, BELFAST.

THE CHAIR WILL BE TAKEN BY THE PRESIDENT,

JAMES STELFOX, Esq., M.Inst.C.E.

The Proceedings on Tuesday commence at 11 a.m., when a welcome will be extended by The Right Honourable the Lord Mayor of Belfast, Alderman James Henderson, M.A., J.P.

On Friday, June 24, there will be an Excursion to Rostrevor, through the Mourne Mountain District.

THE BENEVOLENT FUND.

The Annual General Meeting of the Donors and Subscribers to the Benevolent Fund will be held on Tuesday, June 21, at the close of the sitting, about 2 p.m.

WALTER T. DUNN, Secretary.

13, *Victoria Street, Westminster, S.W.*

BROADSTAIRS GAS COMPANY.

THE Directors of the above-named Company invite TENDERS for the supply of about 3500 Tons of good screened GAS COAL per annum (for One, Two, or Three Years), delivered at Broadstairs Station, or into Carts at Broadstairs Harbour, in such quantities as the Manager may require from time to time.
Tenders to be sent in not later than Monday, July 4, 1898, addressed to the Chairman of the Company.
The Directors do not bind themselves to accept the lowest or any Tender.
Full Particulars can be obtained on application to the undersigned.

W. J. LATCHFORD,
Secretary and Manager.

Broadstairs, June 3, 1898.

LINCOLN CORPORATION.
(GAS DEPARTMENT.)

TENDERS FOR COAL.

THE Gas Committee of the Lincoln Cor- poration invite TENDERS for the supply of 25,000 Tons of screened GAS COALS and NUTS, to be delivered during a period commencing the 1st of July, 1898, and terminating the 30th of June, 1899.
Further Particulars and Forms of Tender may be obtained from the undersigned.
Sealed and endorsed Tenders, addressed to the Chairman of the Gas Committee, must be delivered on or before the 25th inst.
The Committee do not bind themselves to accept the lowest or any tender.

JNO. CARTER,
Manager.

Gas Offices, Lincoln,
June 4, 1898.

LINCOLN CORPORATION.
(GAS DEPARTMENT.)

TENDERS FOR TAR.

THE Gas Committee of the Corporation of Lincoln are prepared to receive TENDERS for the purchase of the surplus TAR (about 1000 Tons) produced at their Works during the period of One Year, commencing on the 1st of July, 1898.
Sealed Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Residuals," must be delivered at the Gas Offices, Lincoln, on or before the 25th inst.
The Committee do not bind themselves to accept the highest or any Tender.
Other Particulars may be obtained of the undersigned.

JNO. CARTER,
Manager.

Gas-Works, Lincoln,
June 4, 1898.

THE Middleton Corporation are pre- pared to receive TENDERS for the supply of CANNEL and GAS COAL (Unscreened and Nuts), delivered at the Middleton Railway Station in such quantities and at such times as the Gas Manager may require.
Tenders, addressed to the Chairman of the Gas Committee must be delivered at my Office on or before Wednesday, the 22nd of June, 1898, endorsed "Tender for Coal or Cannel," as the case may be.
The Corporation do not bind themselves to accept the lowest or any Tender.
Further Particulars and Form of Tender may be obtained by written application only to Mr. T. Duxbury, Gas Manager.

FREDERICK ENTWISTLE,
Town Clerk.

Town Hall, Middleton,
near Manchester, June 2, 1898.

THE Directors of the Petworth Coal Gas and Coke Company invite TENDERS for the supply of 750 Tons of good GAS COAL, to be delivered free at Petworth Station L.B. & S.C. Railway, when required between July, 1898, and July, 1899.
Sealed Tenders, endorsed "Coal," to be sent to the Secretary on or before Friday, July 1, 1898.
The Directors do not bind themselves to accept the lowest or any Tender.
No Tender Forms supplied.

C. H. DOWNS,
Secretary.

Petworth, June 13, 1898.

EAST RIDING ASYLUM, BEVERLEY.

GAS-WORKS EXTENSION.

TO GAS-WORKS ENGINEERS AND BUILDERS.

THE Visiting Committee hereby invite TENDERS for the construction of a new GAS-HOLDER and TANK and SCRUBBER, with the necessary Connections, at the said Asylum.
Plans and Specifications, together with Forms of Tender, may be obtained on and after the 13th inst., from the undersigned, upon depositing £1 1s., which will be returned on receipt of a *bonâ-fide* Tender.
Tenders, endorsed "Gas-Works Extension," to be sent to my Office not later than Twelve noon, on the 28th inst.
The Committee do not bind themselves to accept the lowest or any Tender.
The Contractor will be required to give sufficient security for the due performance of his Contract.

By order of the Visiting Committee,
C. W. HOBSON,
Clerk.

Newbegin, Beverley,
June 10, 1898.

CORPORATION OF ROTHERHAM.

THE Gas Committee of the above Cor- poration are prepared to receive TENDERS for the supply and delivery of the following SOCKET and SPIGOT GAS-MAINS and also for the necessary SPECIAL CASTINGS, &c:—

260	yards of	18-inch	CAST-IRON MAINS.
500	"	14-inch	" "
1870	"	12-inch	" "
500	"	10-inch	" "
2150	"	8-inch	" "
750	"	4-inch	" "

Further Particulars and Forms of Tender may be obtained upon application to Mr. Frank A. Winstanley, Engineer, Gas-Works.
Tenders, to be delivered to the undersigned, not later than Monday, the 20th inst., endorsed "Tender for Gas-Mains," and stating the earliest date upon which the Pipes can be delivered.
The Contractor must pay to his workmen not less than the Standard Rate of Wages paid in the district, and must observe the proper Conditions of Labour; and no Sub-Contracting will be allowed, except by permission of the Corporation.

By order,
H. H. HICKMOTT,
Town Clerk.

Council Hall, Rotherham,
June 11, 1898.

COUNTY BOROUGH OF STOCKPORT.
(GAS AND ELECTRIC LIGHTING DEPARTMENT.)

TO ENGINEERS AND GASHOLDER MAKERS.

THE Gas and Electric Lighting Com- mittee are prepared to receive TENDERS for an OIL-TANK, 23 feet diameter by 20 feet deep, and Connections, Particulars and Drawings of which can be obtained from the Engineer, Mr. S. Meunier, on payment of 10s. 6d., which is not returnable.
Also for a GASHOLDER, STEEL TANK, and PURIFIERS for a GAS-TESTING PLANT. Intending Contractors must submit their own Designs, giving full Details of the work, such Plans and Specification to be delivered into the hands of the Engineer Seven clear days prior to time stated for the Tender to be in.
Tenders, endorsed "Oil-Tank," must be delivered not later than Wednesday, July 6 next ensuing, addressed to the Chairman of the Gas and Electric Lighting Committee, Portwood, Stockport.
The resolution of the Council that Contractors will be expected to pay the Standard Rate of Wages paid in the district will apply to this Contract; and the Committee do not bind themselves to accept the lowest or any Tender.

By order,
WALTER HYDE,
Town Clerk.

Stockport, June 8, 1898.

GLOUCESTER GASLIGHT COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of about 25,000 Tons of GAS COAL for One Year from the 1st day of July next, in such monthly quantities as may be required by the Company.
Tenders to state the price delivered at the Midland Railway Wharf, High Orchard, or the Great Western Railway Wharf, Llanthony, Gloucester; or if sent (as preferred) by Water, the price f.o.b., and also the price delivered at the Gas Company's Wharf on the Gloucester and Berkeley Canal.
Further Particulars and Forms of Tender may be obtained of the Company's Engineer, Mr. R. Morland.
Sealed Tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, to be addressed to the Chairman, Gas Offices, Eastgate Street, Gloucester, and delivered not later than the 1st day of July next.
The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any Tender.

By order,
WILLIAM E. VINSON,
Secretary

Gas Offices, Gloucester,
June 2, 1898.

OAKHAM GAS COMPANY, LIMITED.

THE Directors of the above Company are prepared to receive TENDERS for the supply of about 1000 Tons of best Screened GAS COAL.

For Particulars and Forms of Tender apply to

JAS. MASON,
Manager.

Gas Office, Oakham,
June 10, 1898.

OAKHAM GAS COMPANY, LIMITED.

THE Directors of the above Company are prepared to receive TENDERS for the surplus TAR and AMMONIACAL LIQUOR produced at their Works from July 1 next to June 30, 1899.

For further Particulars, apply to

JAS. MASON,
Manager.

Gas Office, Oakham,
June 10, 1898.

BOROUGH OF SAFFRON WALDEN.

TENDERS FOR COAL.

THE Gas and Water Undertaking Committees of the Town Council are prepared to receive TENDERS for the supply of about 1100 Tons of best screened GAS COAL, and about 130 Tons of best hand-picked hard STEAM COAL respectively for the Twelve Months ending June 30, 1899.

Full Particulars can be obtained on application to Mr. G. William Lacey, Borough Surveyor.

Sealed Tenders, endorsed "Tender for Gas Coal," or "Tender for Steam Coal," as the case may be, to be addressed and sent to me, the undersigned, not later than Five o'clock in the Afternoon, on Monday, the 27th of June inst.

The lowest or any Tender will not necessarily be accepted.

W. ADAMS,
Town Clerk.

Saffron Walden, June 8, 1898.

CORPORATION OF LANCASTER.

(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee are prepared to receive TENDERS for the supply of screened GAS COAL delivered on the Gas-Works Siding, Lancaster, in such quantities and at such times as may be required during a period of One Year, commencing delivery Sept. 1 next.

Sealed Tenders, endorsed "Gas Coal," giving full Particulars of the Coal offered, must be delivered to T. C. Hughes, Esq., Town Clerk, Lancaster, on or before Ten a.m., on the 21st inst.

Forms of Tender may be obtained on application to the undersigned.

The lowest or any Tender not necessarily accepted.

C. ARMITAGE,
Manager.

Gas-Works, Lancaster,
June 31, 1898.

BOROUGH OF ROTHERHAM.

(GAS DEPARTMENT.)

TENDERS are invited for the erection of new PURIFIERS, CONDENSERS, SCRUBBER, STATION METER, &c., &c., and for the REMOVAL to another Site of the existing Condensers, Scrubber, Exhausters, &c.

Plans and Specifications may be seen at the Gas Offices, Rotherham.

The Contractors must not pay less than the Standard Rate of Wages paid in the district, and must observe the proper conditions of labour; and no sub-contracting will be allowed, except by permission of the Corporation.

Sealed Tenders, endorsed "Tender for Purifiers, &c.," and addressed to me, must be sent in not later than Three o'clock on Tuesday, the 21st inst.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
H. H. HICKMOTT,
Town Clerk.

Council Hall, Rotherham,
June 8, 1898.

SUTTON, SOUTHCOATES, AND DRYPOOL GAS COMPANY, INCORPORATED, HULL,

INVITE Tenders for the surplus Tar, also for the whole of the AMMONIACAL LIQUOR produced at their Works, at per Ton over the Company's Weighing-Machine, from the 1st of July, 1898, to the 30th of June, 1899, both inclusive.

Probable quantity of Tar . . . . 900 Tons.
Ditto, Ammoniacal Liquor . . . 1100 Tons.

Both Tar and Ammoniacal Liquor to be taken from the Company's elevated Tank into Contractor's Carts, which must be supplied as required by Vendors.

Tenders for Ammoniacal Liquor must state price per degree Twaddel's Hydrometer from 4° to 8°.

Further Particulars may be obtained from the Manager at the Gas-Works, St. Mark's Street.

Tenders to be sent to the undersigned on or before the 27th of June, 1898, endorsed "Tender for Tar or Liquor."

The Company do not bind themselves to accept the highest or any Tender.

DAVID WOOD,
Secretary.

Offices: St. Mark's Street, Hull,
June 3, 1898.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to DEBENTURE STOCK only, WILL BE CLOSED on the 24th inst., and RE-OPENED on the 1st of July.

S. J. WILLIAMS,
Secretary.

63, Chancery Lane, W.C.,
June 13, 1898.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held MONTHLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by Auction of Gas and Water Stocks and Shares under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. Alfred Richards's Offices, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.

BRENTFORD GAS COMPANY.

£15,000 OF NEW STOCK 1881.

Ranking for a Standard Dividend of 7 per cent. per annum subject to the Sliding-Scale; the last Dividend on similar Stock having been at the rate of 9 per cent.

MR. ALFRED RICHARDS will Sell the above BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Monday, July 18, at Two o'clock precisely, in Lots.

Particulars may be obtained of the SECRETARY of the Company, at the Offices, BRENTFORD; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.

CRYSTAL PALACE DISTRICT GAS COMPANY.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Wednesday, June 29, at Two o'clock, in Lots.

£20,000 FIVE PER CENT. PERPETUAL DEBENTURE STOCK

OF THE

CRYSTAL PALACE DISTRICT GAS COMPANY,

To be created under the Provisions of the Crystal Palace District Gas Act, 1893.

Particulars at the COMPANY'S OFFICES, LOWER SYDENHAM, and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

£7500 STOCK.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Monday, June 20, at Two o'clock precisely, in Lots

£7500 OF "A" ORDINARY STOCK OF THE BRIGHTON AND HOVE GENERAL GAS COMPANY,

Ranking for a Standard Dividend of 7 per cent. subject to the Sliding-Scale; the last Dividend on similar Stock having been 8½ per cent.

Particulars of the SECRETARY of the Company, at No. 5, GREAT WINCHESTER STREET, E.C., and 77, West Street, BRIGHTON, and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

COLNEY HATCH GAS COMPANY.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Monday, June 20, at Two o'clock, in Lots.

£3000 OF ADDITIONAL STOCK

OF THE

COLNEY HATCH GAS COMPANY,

Ranking for a Maximum Dividend of 7 per cent. per annum; the last Dividend on the Company's 7 per cent. Capital having been at this rate.

Particulars of the SECRETARY, at the Company's Offices, 5 & 6, GREAT WINCHESTER STREET, E.C.; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.

GUILDFORD GASLIGHT AND COKE COMPANY.

MR. ALFRED RICHARDS will Sell by AUCTION, at the Mart, E.C., on Monday, July 4, at Two o'clock.

£5000 of ORDINARY STOCK

IN THE

GUILDFORD GASLIGHT & COKE COMPANY,

Ranking for a Standard Dividend of 5 per cent.; the last Dividend on similar Stock having been at this rate.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.

SOUTHEND GAS COMPANY.

850 £10 SHARES.

Ranking for a Standard Dividend of 7 per cent. subject to the Sliding-Scale; the last Dividend on similar Shares having been 7½ per cent.

MR. ALFRED RICHARDS will Sell the above BY AUCTION, at the Mart, E.C., on Monday, July 4, at Two o'clock, in Lots.

Particulars at the COMPANY'S OFFICES, SOUTHEND; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.

WHITCHURCH AND DISTRICT (HANTS) GAS COMPANY LIMITED.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Monday, July 4, at Two o'clock.

150 £10 FULLY-PAID ORDINARY SHARES

IN THE

ABOVE UNDERTAKING.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Executors of the late John Young, Esq.

DORKING GAS COMPANY.

FIFTY £25 FULLY-PAID "A," "B," & "C" SHARES.

MR. ALFRED RICHARDS will Sell the above BY AUCTION, at the Mart, E.C., on Monday, July 4, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

BOROUGH OF EVESHAM,

(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Corporation invite Tenders for the supply of from 1000 to 2000 Tons of best screened GAS COAL, during the Year ending the 30th of June, 1899, to be delivered on Rail at Evesham.

Tenders to be sent in to me not later than the 30th of June inst., to include full Description and Particulars as to Coal and Price. No Forms of Tender supplied.

The Corporation do not bind themselves to accept the lowest or any Tender.

THOS. COX,
Town Clerk.

Town Clerk's Office, Evesham,
June 8, 1898.

COUNTY BOROUGH OF BURY.

(GAS DEPARTMENT.)

THE Corporation of Bury are prepared to receive TENDERS for the supply for One, Two, or Three Years, of

3,000 Tons of CANNEL per annum.
30,000 Tons of GAS COAL per annum.
500 Tons of BURGY per annum.
200 Tons of HOUSE COAL per annum.

The same to be delivered in such quantities and at such times as the Gas Engineer of the Corporation may from time to time order.

Printed Forms of Tender and Conditions of Contract may be obtained on application to Mr. H. Simmonds, Engineer, Gas-Works, Bury.

Tenders, which must be on the printed forms and addressed to the Chairman of the Gas Committee, Town Clerk's Office, Bury, marked "Tender for Coal," to be delivered not later than the 17th of June, 1898.

JOHN HASLAM.

Corporation Offices, Bank Street,
Bury, May 26, 1898.

BRIERLEY HILL DISTRICT GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors are prepared to receive TENDERS for the supply of 7000 Tons of GAS COAL, delivered to Brettell Lane or Round Oak Siding (G.W.R.), in such quantities as may be required from the 1st of July to the 30th of June, 1899.

Tenders, stating Price per ton (20 cwt.), delivered to the above-mentioned Stations, with latest Analytical Test, to be sent, addressed to the Chairman of the Company, and marked "Tender for Coal," not later than the 30th inst.

The Directors reserve the right to accept Tenders for the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any Tender.

No Tender Forms issued.

By order,
HENRY M. JACKSON,
Secretary.

Board-Room, Gas-Works,
Brierley Hill, June 6, 1898.

SHREWSBURY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shrewsbury Gaslight Company invite TENDERS for the supply of about 12,000 Tons of Screened GAS COAL, and about 1000 Tons of good ENGLISH CANNEL, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbury, during One, Two, or Three Years, commencing July 1, 1898.

The Directors reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any Tender.

Tenders must be made on Forms (containing further Particulars) which may be obtained on application at the Company's Works, or by post, and must be sent to the undersigned, on or before the 17th day of June, 1898.

By order,
WM. BELTON, Assoc.M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 18, 1898.

COMMERCIAL GAS COMPANY.

TENDERS FOR COAL.

THE Directors are prepared to receive TENDERS for the supply of 180,000 Tons of clean dry, unscreened, fresh-wrought GAS COALS, delivered f.o.b. to the Company's Steamers at any suitable Port, during the Year ending the 30th of June, 1899.

The deliveries to be in equal monthly quantities throughout the Year.

Payment in cash monthly.

Parties desiring to tender for more than One Year must state separately the price and quantity offered for each Year.

Particulars and Forms of Contract may be obtained from the Engineer & General Manager, Mr. H. E. Jones.

The Directors do not bind themselves to accept the lowest or any Tender.

Tenders, sealed and endorsed "Tender for Coals," to be addressed to the Chairman of the Coal Committee, and delivered at the Company's Offices not later than Ten o'clock on the 16th of June prox.

Commercial Gas-Works, Stepney, E.,
May 31, 1898.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company so far as they relate to the DEBENTURE STOCK WILL BE CLOSED at Ten o'clock forenoon on Thursday, the 16th inst., and RE-OPEN on Thursday, the 23rd inst.

The Interest for the Half Year to the 30th of June, 1898, will be payable on the 1st day of July next to the Proprietors registered on the closing of the Books.

By order,
JAMES RANDALL,
Secretary.

Offices: Willoughby Lane,
Tottenham, June 9, 1898.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883 TO 1888.

NOTICE is Hereby Given, that Charles Eardley Billing, of 100, Abbey Road, West Hampstead, Co. Middlesex, has APPLIED FOR LEAVE TO AMEND THE SPECIFICATION OF THE LETTERS PATENT No. 30,132, of 1897, for "Improvements in the Construction of Gas-Burners."

Particulars of the proposed Amendments were set forth in the "Illustrated Official Journal (Patents)" issued on the 8th of June, 1898.

Any person or persons may give Notice of Opposition to the Amendment (on Form G), at the Patent Office, 25, Southampton Buildings, London, W.C., within One Calendar Month from the date of the said "Journal."

C. N. DALTON,
Comptroller-General.

ABEL & IMRAY,
Consulting Engineers and Chartered Patent Agents,
Birkbeck Bank Chambers, Southampton Buildings,
London, W.C., Agents for the Applicant.

SALE OF £50,000 PERPETUAL FOUR PER CENT. DEBENTURE STOCK.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

THE Directors of the above Company give notice that they will be prepared to receive TENDERS for the above STOCK in sums not less than £25 or multiples thereof.

The Stock will be issued free of Stamp Duty and all other Expenses.

Printed Tender Forms and Particulars of Conditions of Sale, with all other Information necessary, can be had on application to the Secretary of the Company, at the Company's Offices, D'Olier Street, Dublin, or will be forwarded to any part of the country on application.

Tenders must be delivered at the Company's Offices, D'Olier Street, on or before Thursday, the 30th inst.

By order,
W. F. COTTON,
Secretary and Manager.

Board Room, D'Olier Street,
Dublin, June 1, 1898.

CRYSTAL PALACE DISTRICT GAS COMPANY,

SALE BY AUCTION OF £20,000 FIVE PER CENT. PERPETUAL DEBENTURE STOCK.

NOTICE is Hereby Given, that the Directors have instructed Mr. Alfred Richards, to SELL BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on the 29th day of June next, £20,000 of FIVE PER CENT. PERPETUAL DEBENTURE STOCK OF THE COMPANY, pursuant to the Powers contained in the Crystal Palace District Gas Act, 1893 (56 & 57 Vic.), and the Resolution passed at a Meeting of Proprietors.

Purchasers to make full payment before the 13th day of July, from which date Interest will accrue, payable on the 15th day of January, and the 15th day of July in each year, calculated to the expiration of the preceding Half Year.

Particulars and Conditions of Sale can be obtained at the Offices of the Company, Lower Sydenham, London, S.E.; of the Solicitors, Messrs. Blyth, Dutton, Hartley, and Blyth, 112, Gresham House, Old Broad Street, E.C.; and of the Auctioneer, 18, Finsbury Circus, E.C.

By order of the Board,
CHARLES M. OHREN,
Secretary.

Offices and Works:
Lower Sydenham, S.E.,
May 27, 1898.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

GAS PURIFICATION BY
HYDRATED OXIDE.

THIS Material is of full Strength, and Exceptional Activity. It is specially prepared to minimize Back-Pressure; and will be supplied on Hire, or Sold, on the most favourable Terms.

SPENT OXIDES containing Blue, also CRUDE FERRO-CYANIDE PRODUCTS, either PURCHASED or EXCHANGED for FRESH OXIDE.

MANCHESTER OXIDE COMPANY, LTD.,
CANAL ST., MILES PLATTING, MANCHESTER.

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to Mr. EDWARD PRICE, 119, Queen's Road, FINSBURY PARK, N.

Prices are Reduced.

Telephone: Castleford No. 214. | Postal Address: Castleford.

Telegrams: "Silkstone Castleford."

THE SILKSTONE & HAIGH MOOR COLLIERIES, LTD.

ALLERTON BYWATER, CASTLEFORD.

Steam, Manufacturing, & Gas Coals & Cannel.

Analysis, Contracts, Trial Waggons, and Quotations for Large and Small Orders. Inquiries Solicited.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY, LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas. Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.

CHESTERFIELD.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day. Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

SEAHAM HARBOUR, COUNTY OF DURHAM.

Ready this Day—450 Pages, Crown 8vo., with numerous Illustrations, 10s. 6d. Leather.

THE

GAS ENGINEER'S POCKET BOOK,

Comprising Tables, Notes, and Memoranda relating to the Manufacture, Distribution, and Use of Coal Gas, and the Construction of Gas-Works.

By HENRY O'CONNOR, Assoc.M.Inst.C.E.

London: CROSBY LOCKWOOD & SON,
7, STATIONERS' HALL COURT, E.C.

THOMAS DUXBURY & CO.,

16, DEANSGATE, MANCHESTER.

Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.

Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.
8 Lombard Street,
NEWCASTLE-ON-TYNE.

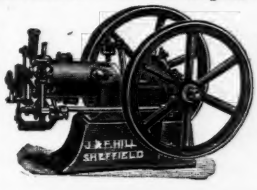
W. RICHARDSON, Fitter.

HILL'S IMPROVED

"OTTO" TYPE GAS-ENGINES

½ H.P. to 20 H.P. Specially designed for Users of Small Power.

GAS-ENGINES & DYNAMOS complete for HOTEL, HOUSE, and SHOP Installations.



Gas-Engines and Pumps.

High-Class Workmanship.

J. & P. HILL,
Backfields & Norfolk Iron-Works,
SHEFFIELD.

HOLMSIDE GAS COALS.

Present Daily Produce over 5000 Tons.

Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . . 11,205 Cubic Feet.
Illuminating Power $16\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality) $13\frac{3}{4}$ Cwt. per Ton.
Sulphur . . . . . A little over 1 per Cent.
Ash . . . . . Under 1 per Cent.
Tar . . . . . 163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor 103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR

PELTON GAS COALS.

Present Daily Produce available 3000 Tons.

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,

HOLMSIDE & SOUTH MOOR OFFICES,

NEWCASTLE-UPON-TYNE.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: R. CULL, 84, OLD BROAD ST., E.C.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895,*

Yield of Gas per Ton	10,500 Cub. Ft.
Illuminating Power	16·9 Candles.
Coke (of good quality)	67·5 per Cent.
Sulphur	0·58 „
Ash	2·73 „

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

WELDON MUD

FOR

GAS PURIFICATION,

For use in the

RECOVERY OF SULPHUR,

ALSO

Removal of last Traces of SULPHURETTED HYDROGEN in catch position.

Full Particulars on application to the Patentees:

GAS DESULPHURIZATION CO.,

— *LIMITED,* —

1, FENCHURCH AVENUE, LONDON, E.C.

WATERBLEAN PAINT

TELEGRAMS: "EVESON, BIRMINGHAM."

EVESON FOR CANNEL

TUBES AND FITTINGS

ALL KINDS

WRITE FOR PRICES

STAFFORDSHIRE TUBE Co., BIRMINGHAM.

COKE-BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT)

With Elevators and Conveyors worked by Steam or Gas Engine.

GEORGE WALLER & CO.,

165, QUEEN VICTORIA STREET, E.C.

And at STROUD, GLOUCESTERSHIRE.

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per ton	10,500 Cubic Feet.
Illuminating Power	16·9 Candles.
Coke	66·7 Coke.
Sulphur	0·86 Sulphur.
Ash	2·04 Ash.

For Prices, &c., apply to

W. H. PARKINSON,

THE HARTON COAL CO., LTD.,

NEWCASTLE-ON-TYNE.

Telegraphic Address: "PARKINSON NEWCASTLE."

INCANDESCENT GAS LIGHTING

Has now gained a complete and final Victory over its last and greatest Enemy

VIBRATION,

BY MEANS OF

CLAY'S PATENT

SHOCK-PROOF

Incandescent Burner Fittings

Of which full Particulars may be had from

CLAY & WALMSLEY,

BOLTON, ENGLAND.

Telegrams: "CLAYS, BOLTON."

See "JOURNAL OF GAS LIGHTING," July 7, 1896, p. 19, and Dec. 21, 1897, p. 1365.

London Representatives: Messrs. Henry Greene & Sons, 153 & 155, Cannon Street, E.C.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

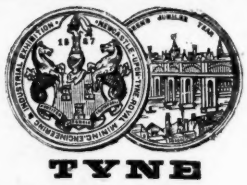
SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:

90, CANNON STREET, E.C.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.



TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft
Illuminating Power	38·22 candles
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI, LONDON, W.C

REGENERATIVE RETORT-SETTINGS.

J. FIRTH BLAKELEY & CO., GAS ENGINEERS AND CONTRACTORS, RAVENSTHORPE, YORKS,

Have made arrangements with Mr. ALEXANDER YUILL, of Alloa, N.B., for the SOLE RIGHT of BUILDING his REGENERATIVE FURNACES and SETTINGS OF RETORTS.

By Mr. Yuill's Principle, the maximum quantity of Gas per Retort per diem may be obtained with the minimum amount of fuel.

Gas Managers who are desirous of improving their Settings should ask for Particulars and Prices before adopting any other principle.

They give the best results, are reliable, and economical in construction.

GAS APPARATUS OF ALL KINDS SUPPLIED.

SAWER & PURVES, NELSON METER WORKS, MILES PLATTING, MANCHESTER,

MANUFACTURERS OF

IMPROVED WET GAS-METERS IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

IMPROVED DRY GAS-METERS.

Speciality: PATENT CASH PREPAYMENT METERS.

CATALOGUE SENT ON APPLICATION.

MOBBERLEY & PERRY STOURBRIDGE.

Manufacture & supply best quality of

Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)

Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.

FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c., &c.

EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.

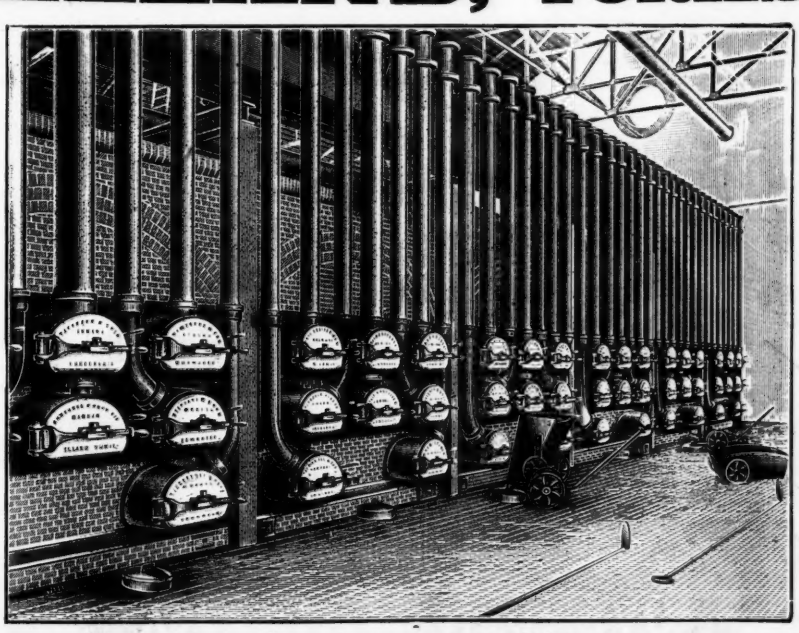
London Agents: Contractors for the erection of Retort-Benches complete.

BALE & HARDY, Gas Engineers and Contractors, BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C.

R. DEMPSTER & SONS, LIMITED.

ELLAND, YORKS.

DIRECT-FIRED GENERATOR AND REGENERATOR SETTINGS



AND RETORT WORK IN ALL ITS BRANCHES.

REGENERATIVE RETORT-BENCH ERECTED COMPLETE BY R. D. & S., Ltd. (From a Photo.)

CONTRACTORS FOR COMPLETE INSTALLATIONS ON HORIZONTAL OR INCLINED SYSTEMS WITHOUT SUB-CONTRACTING.

G. & J. HAIGH,

Raven's Lodge Fire-Brick Works, DEWSBURY

Manufacturers of MACHINE-MADE RETORTS and

FIRE-BRICKS of the highest Quality, made from Fire-Clay of a most Superior and Refractory Character, suitable for **GLASS-WORKS, GAS-WORKS, and BLAST-FURNACES.**

For Prices and Analysis, apply as above.

MAURICE GRAHAM, Managing-Director.

Telegrams: "ACCOUPLE, LONDON."

GRAHAM, MORTON, & CO.

LIMITED,

GAS ENGINEERS & CONTRACTORS

INCLINED RETORT PLANTS—CONVEYING MACHINERY.

Send for our latest Pamphlet upon Inclined Retort Construction.

HEAD OFFICE: 79 & 80, AMBERLEY HOUSE, NORFOLK ST., STRAND, LONDON, W.C.

HANNA, DONALD, & WILSON,

(Established 1851),

GAS ENGINEERS & CONTRACTORS,

Abercorn Foundry and Abbey Works,

PAISLEY, N.B.,

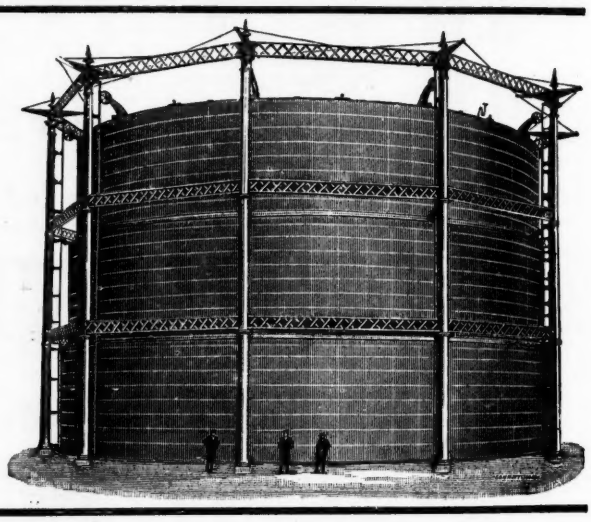
MAKERS OF

Gasholders and Gas Plant

OF EVERY DESCRIPTION.

Sole Agents for Scotland for the Automatic Coal-Gas Retort (Inclined System) Company, Limited.

Telegraphic Address: "Donald, Paisley."



LONDON OFFICE

60, QUEEN VICTORIA ST. E.C.

TELEGRAPHIC ADDRESSES "DRAKESON HALIFAX." "ECLAIRAGE LONDON."

TELEPHONE No. 43. "HALIFAX EXCHANGE"

GAS ENGINEERS. CONTRACTORS. IRONFOUNDERS.

JONAS DRAKE & SON

SOLE AGENTS FOR

HISLOP'S

PATENT REGENERATIVE FURNACES

—FOR—

ENGLAND, WALES & ABROAD.

RETORT BENCHES ERECTED COMPLETE WITH OR WITHOUT SPECIAL FURNACES. RESULTS GUARANTEED.

OVENDEN HALIFAX

RETORT SETTERS. FURNACE BUILDERS. ETC. ETC.

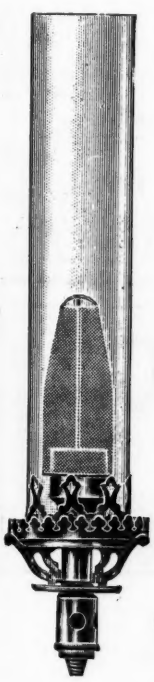
Designs and Estimates on Application.

GASEOUS FIRING A SPECIALTY.

THE SUNLIGHT INCANDESCENT GAS-BURNER.

NEW POPULAR PRICES.

BURNERS



COMPLETE FROM

3/10 each.

WITH BYE-PASS, 5/-.

MANTLES

per 9/- doz.

THE IDEAL LIGHT FOR DOMESTIC USE.

SUNLIGHT MANTLES

PRODUCE A DIFFUSED LIGHT OF SOFT RAYS,

The NEAREST APPROACH to the LIGHT of the SUN.

Price Lists, &c., on application.

The NEW INCANDESCENT (SUNLIGHT PATENT) GAS LIGHTING CO., LIMITED,

33 & 34, SHOE LANE, LONDON.

JOSEPH EVANS & SONS, CULWELL WORKS, WOLVERHAMPTON.

PLEASE APPLY FOR CATALOGUE No. 8.

Telegrams: "EVANS, WOLVERHAMPTON." National Telephone No. 7089.

TRADE MARK.

FIRST AWARDS EVERYWHERE.

SEE NEXT WEEK'S ADVERTISEMENT FOR STEAM-PUMPS, &c.

HISLOP'S PATENT REGENERATIVE RETORT-SETTINGS

THESE SETTINGS SECURE THE RECORD PRODUCTION OF

1000 CUBIC FEET OF GAS PER LINEAL FOOT OF RETORT (Ordinary Section) per 24 HOURS from ENGLISH COAL, and

1200 CUBIC FEET FROM SCOTCH COAL,

Together with every other possible Advantage.

DURABILITY AND SIMPLICITY OF MANAGEMENT. LOWEST POSSIBLE FUEL ACCOUNT. PERFECT SATISFACTION GUARANTEED.

AGENTS: *Messrs. JONAS DRAKE & SON, Gas Engineers, Halifax, Yorkshire, for* ENGLAND, WALES *and* ABROAD. *C. M. HAMILTON, Retort Setter, Hamilton, for* SCOTLAND *and* IRELAND. *Enquiries may be addressed in the first instance, to the* PRINCIPAL AGENT:

R. F. HISLOP, Gas Engineer, CRAIGIELEA, PAISLEY.

COAL UNLOADING AND CONVEYING MACHINERY.

Also Makers of

LIQUOR TANKS,
RACK AND SCREW VALVES,
HYDRAULIC HOISTS AND PUMPS,
AIR-COMPRESSORS,
MACHINERY FOR HORIZONTAL AND INCLINED RETORTS.
BUCKSTAVES, COLUMNS,
STAGE-FLOOR GIRDERS, &c.
RETORT MOUTHPIECES,
REGENERATIVE RETORT-SETTINGS.
ASCENSION, ARCH, AND DIP PIPES.
COAL AND CANNEL BREAKERS.
COKE BREAKERS AND SCREENS.
COKE STORING
AND SCREENING PLANT,
GAS COMPRESSORS AND EXHAUSTERS,
TUBULAR CONDENSERS,
COOLERS, CAPSTANS,
LIVESEY WASHERS,
GAS-ENGINES,
FLOOR-PLATES,
ROOFS.

W. J. JENKINS & CO., LTD., RETFORD.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS,
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

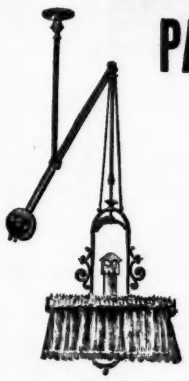
1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT

MACHINE-MADE GAS-RETORTS.

BEST & LLOYD

MAKERS OF THE BIRMINGHAM. Limited,



PATENT "SURPRISE" PENDANT,

WITH PATENT SHADE.

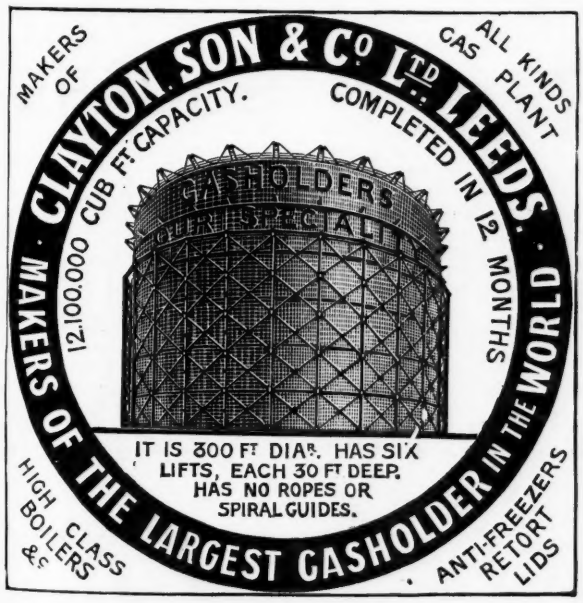
The ONLY GAS-PENDANT suitable for Domestic Lighting; a room 18 ft. by 14 ft. being beautifully illuminated with one Incandescent Burner.

Extract from the JOURNAL OF GAS LIGHTING, Jan. 8, 1895.

"IN CONJUNCTION WITH

THE INCANDESCENT GAS-LIGHT

it quite **supersedes** the familar three-light pendent. We are able to bear witness to the **convenience** of the New Pendant."


MAKERS OF
CLAYTON, SON & Co LTD LEEDS
ALL KINDS GAS PLANT
12,100,000 CUB FT CAPACITY.
COMPLETED IN 12 MONTHS
GAS HOLDERS
SPECIALITY
IT IS 300 FT DIAM. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD
HIGH CLASS BOILERS &c
ANTI-FREEZERS RETORT LIDS

GIRDERS, ROOFS, & ALL KINDS OF STRUCTURAL IRONWORK.

London Office: 60, QUEEN VICTORIA STREET, E.C.

Telegraphic Addresses: "GAS, LEEDS," "ECLARAGE, LONDON."

THE

DENAYROUZE

LIGHT SYNDICATE

WERE THE

PIONEERS OF NO CHIMNEYS,

and still hold their own on the market for the

HIGHEST
CANDLE POWER

for each Cubic Foot of Gas at ordinary Pressures.

The Syndicate's Three-Light Cluster, governed to consume only 24 Cubic Feet of Gas per Hour, gives

550-CANDLE POWER,

which speaks for itself.

The Syndicate work under the

BANDSEPT PATENTS;

and Bandsept, who was the first to adopt the Injector Principle, is

STILL
AHEAD OF ALL RIVALS;

and the combination of his Burners with Welsbach Mantles can be fearlessly tested against any others

ON THE MARKET.

Call and see these Burners

AT THE

OFFICES OF THE SYNDICATE,

28, VICTORIA STREET, S.W.

CHARLES EDWARD MASTERMAN,
General Manager.

TESTED, TRIED, AND TRUE.

INCANDESCENT GAS-LIGHT

Better than all other Incandescent Systems, and not Infringing any Patent.

Complete, with Burner and Mantle, £5 5s. per 100.
Incandescent Mantles ready for use, £1 15s. per 100.

These Articles are made from the very best Materials. They will last a very long time, and give more light than the generality of other Systems.

The "UNION" INCANDESCENT GAS-LIGHT CO.
WACHSNER & JONAS,
BERLIN O. 2a An der Stadtbahn 2a.

PETTIGREW'S PATENT

Sulphate of Ammonia Plant

ON THE CONTINUOUS SYSTEM

Is the newest in the Market, and is the outcome of practical experience in Sulphate Making.

Old Systems easily and cheaply converted.

ANY SIZE ERECTED COMPLETE AT HOME OR ABROAD.

Makers of Self-Emptying Saturators.

Write for Particulars, Testimonials, and References to

GEO. PETTIGREW & Co.,
GAS AND CHEMICAL ENGINEERS,
MIDDLESBROUGH-ON-TEES.

WILSON CARTER & PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.

ADDRESS CHIEF OFFICES:

Temple Buildings, 50, New Street, Birmingham.

ARROL-FOULIS

Patent Automatic Machinery
FOR
DRAWING AND CHARGING GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,

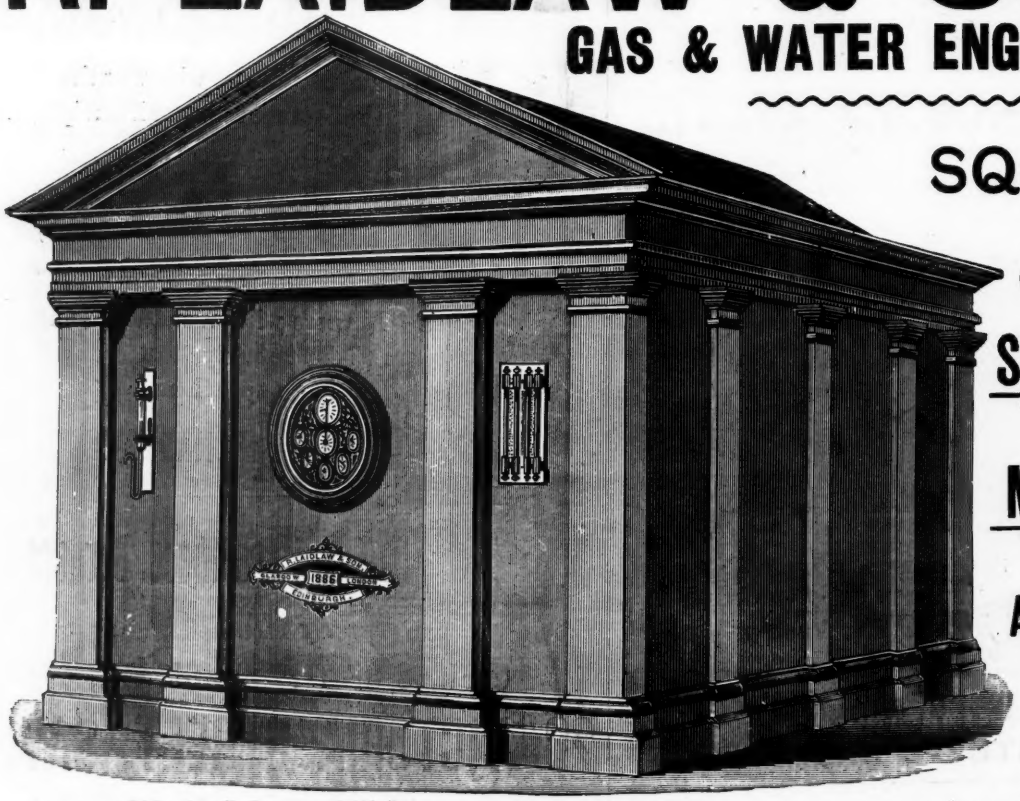
SIR WILLIAM ARROL & CO., Limited,
GLASGOW.

[See Illustrated Advertisement, June 7, p. 1295.]

HARRIS & PEARSON,
STOURBRIDGE, ENGLAND
MANUFACTURERS OF
FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.
GLAZED BRICKS AND PORCELAIN BATHS.

R. LAIDLAW & SON

GAS & WATER ENGINEERS.



SQUARE

(OR ROUND)

STATION

METERS

ALL SIZES.

SIMON SQUARE WORKS, EDINBURGH. | ALLIANCE FOUNDRY, GLASGOW. | 6, LITTLE BUSH LANE, LONDON.

HARPER & MOORES,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.
Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.
MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.
ESTABLISHED 1826.

BOWENS' Ltd. Successors,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.
Established 1860.

JOSEPH CLIFF & SONS,
INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.
WORTLEY, LEEDS.

LONDON OFFICES & DEPÔTS:
Baltic Wharf, Waterloo Bridge.
WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.
LIVERPOOL:
16, Lightbody Street.
LEEDS:
Queen Street.

MACHINE-MADE RETORTS

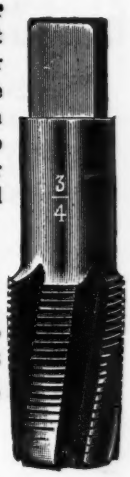
Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

PATENT TWISTED TAPER
RYMERS & TAPS.

These **Patent Twisted Taper Rymers and Taps** are the best ever made for Gas and Water Service Connections. A true Hole and a correct Thread can be assured. They are easy to work, and will last much much longer than straight grooved Taps and Rymers.

THOUSANDS ARE IN DAILY USE.



Also SCREWING-MACHINES, STOCKS and DIES (with Patent Twisted Dies), PIPE-TONGS, and other TOOLS.

Apply for Prices and Particulars to
JOHN RUSCOE,
ALBION WORKS, HYDE, near MANCHESTER.

R. & J. DEMPSTER, LTD., GAS PLANT WORKS,

Telegraphic Address: "SCRUBBER, MANCHESTER." National Telephone Nos. 54 and 2296.

NEWTON HEATH, MANCHESTER.

Coke Elevator, Breaker, and Screening Plant erected at the Gas-Works, Shrewsbury.

COKE and COAL ELEVATORS and CONVEYORS, SCREENS, &c., of various Types and of any Capacity.

Particulars and Prices on Application.

W. PARKINSON & CO.

SQUARE STATION METERS.

All the Meters (which number 14) at the Beckton Station of THE GASLIGHT AND COKE COMPANY have been erected by the above Firm.

PARKINSON'S PATENT EQUILIBRIUM GOVERNORS.

A very large number are now at work; and all Engineers who have adopted them speak in unqualified terms of their great efficiency.

COUNTERBALANCE or AIR VESSEL, as desired.
TWO, FOUR, or SIX COLUMNS and GIRDERS.
WEIGHTS or WATER PRESSURE.

COTTAGE LANE WORKS, CITY ROAD,
LONDON.
Telegraphic Address: "INDEX."
Telephone No. 778 King's Cross.

BELL BARN ROAD WORKS,
BIRMINGHAM.
Telegraphic Address: "GAS-METERS."
Telephone No. 1101.
[See also Advt. p. 1364.

LONDON: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London,—Tuesday, June 14, 1898.